

WARPAINT ARMOUR 2

# NATO ARMOUR 1991-2020

NATO Armour from the End  
of the Cold War to Today



Edited by David Grummitt

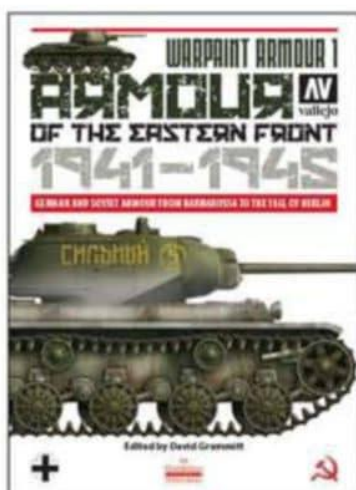
  
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# Warpaint Armour

**Warpaint Armour** is an exciting new series by **Guideline License Publications**. Each title will cover an important conflict or period, looking at the tanks and other armoured fighting vehicles that shaped pivotal moments in the history of modern warfare. Illustrated throughout with archival images and specially commissioned colour profiles, it will showcase the latest research with articles written by an international team of experts, providing information and inspiration to modellers and military history enthusiasts alike.



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In each volume you will find a range features articles covering both well-known and more obscure AFVs, as well as accounts of campaigns and the role of armour in both war and peace. The series will take us from the origins of armoured warfare on the Western Front to the latest in military technology and the preparations made by today's militaries for future conflict.

In conjunction with Acrylicos Vallejo and Military Modelcraft International, the UK's number military modelling monthly, the articles are written with a modeller in mind. Each volume also features a modelling gallery, showcasing some of the finest models that have been seen in Military Modelcraft International over the last decade, as well as some not previously seen in print.





# Contents

## **Challenger 2**

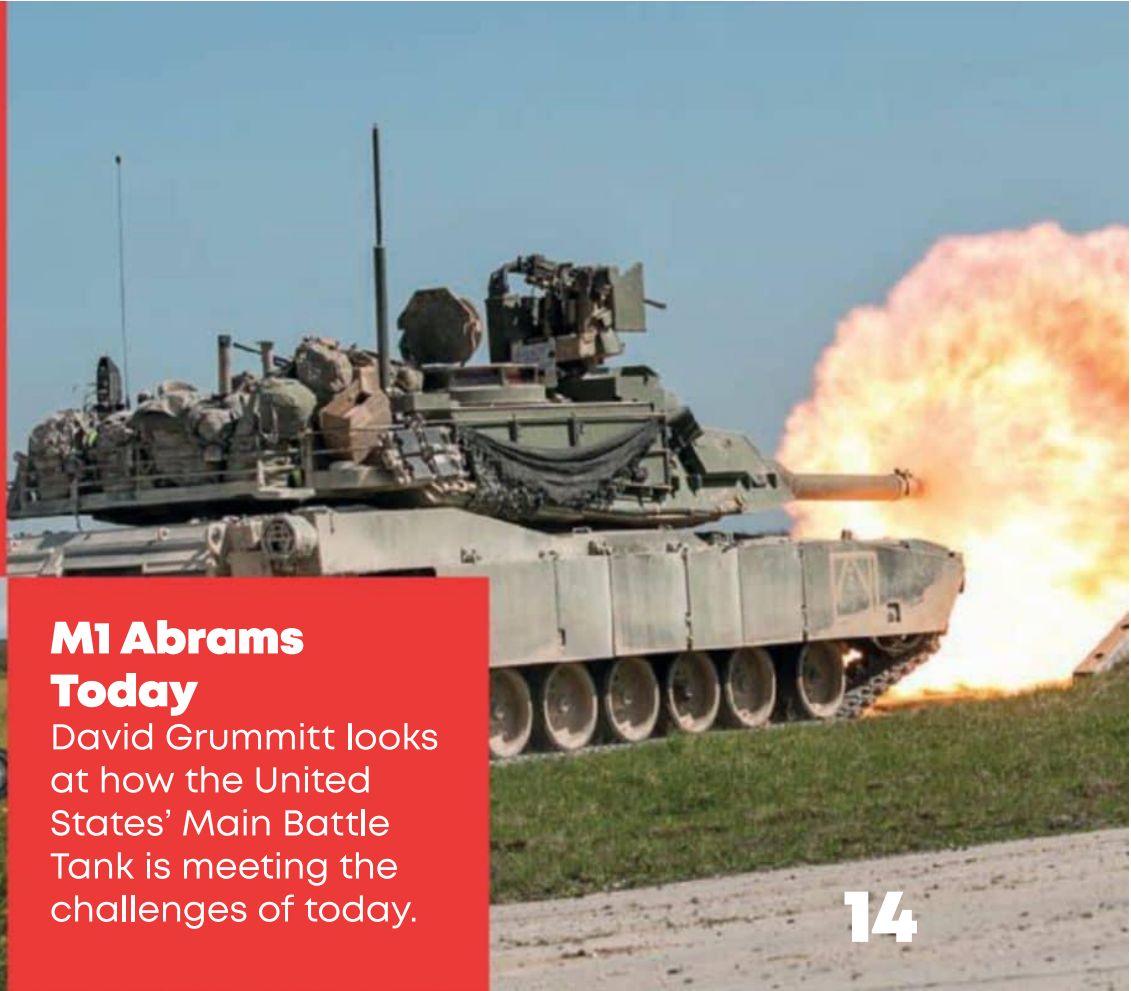
M P Robinson provides some background on the United Kingdom's current MBT.



**5**

## **M1 Abrams Today**

David Grummitt looks at how the United States' Main Battle Tank is meeting the challenges of today.



**14**



**23**

## **Stryker Interim Combat Vehicle**

David Grummitt examines the U.S. Army's wheeled combat vehicle.



**32**

## **The King of Battle**

David Grummitt examines the long-serving M109 Self-Propelled Howitzer.

## **Modelling Gallery**

Some modelling projects inspired by the AFVs featured in this book.



**42**

## **FV510 Warrior**

M P Robinson looks at Britain's Infantry Combat Vehicle.



**46**



**55**

## **M2/M3 Bradley**

David Grummitt examines the United States Army's versatile Bradley Fighting Vehicle.



**64**

## **Leopard 2**

David Grummitt looks at the NATO standard Main Battle Tank.

## **Iron Wolf 18**

Stefan Degraef and Edwin Borremans report from NATO's enhanced Forward Presence Lithuania Battleground Evaluation.



**74**

## **Allies and Partners**

David Grummitt looks the eclectic mixture of AFVs in service with the Alliance and its partners.



**78**

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# Introduction

NATO, or the North Atlantic Treaty Organisation, came into being on 4 April 1949 with the signature of the North Atlantic Treaty. Its origins lay in the mutual defence agreement between France and the United Kingdom two years earlier in the face of a possible Soviet attack. By 1955, when the Federal Republic of Germany was inducted into the Alliance, it stood as a rival military and political block to the Soviet-led Warsaw Pact. From the mid 1950s to the fall of the Berlin Wall in 1989 the rival forces of NATO and the Warsaw Pact faced each other across the West German border. Annual exercises on both sides rehearsed the scenario of a massed Warsaw Pact attack across the central German plain and NATO attempting to hold the line until, inevitably, the conflict moved towards a tactical, and then strategic, exchange of nuclear weapons.

All this changed with the collapse of the Soviet Union and the disbanding of the Warsaw Pact in July 1991. The so-called Peace Dividend saw a reduction in conventional forces across Europe, the United States and the former Soviet Union. The massed armour formations that had characterised the

armies of both sides during the Cold War were now either mothballed or abandoned for scrap. Yet military and political challenges continued. In 1992 NATO became involved in the conflict caused by the breakdown of the former Yugoslavia, first in Bosnia and later in Kosovo. In September 2001 NATO faced the first real test of its collective resolve with the terrorist attacks in New York and Washington, D.C. This led to the still-continuing NATO mission to Afghanistan and to the intervention in Libya. The 'war on terror' led to a fundamental shift in NATO, and especially American, military doctrine, away from conventional warfare and towards counter-insurgency and asymmetric warfare.

This situation was transformed in 2014 with the Russian annexation of Crimea, its intervention in Ukraine and a perceived threat to the security of the Baltic states and those former Warsaw Pact nations that had joined NATO since 1991. Operation Atlantic Resolve saw millions of US dollars and thousands of US personnel deployed once more to

**Above left: A Polish Rosomak prepares to cross a Ribbon Bridge over the Zly Leg Lake at the Drawsko Pomorski Training Area during Exercise Saber Strike 18. (U.S. Army photo by Sgt. Ashley Terpsma)**

**Above centre: An M1A2 SEP V2 of 1-68 Armor, 3rd Armored Brigade at the Grafenwoehr Training Area in August 2017. (U.S. Army photo by Gertrud Zach)**

**Above: A Challenger 2 of the Queens Dragoon Guards during Exercise Bavarian Charger in May 2013. (Ministry of Defence photo by Cpl Wes Calder)**

Europe to bolster European security. Other NATO countries expanded and modernised their conventional forces as the threat of a peer-on-peer conventional conflict in Europe with the Russian Federation again raised its head.

This volume looks at some of the most important armoured fighting vehicles currently deployed by NATO allies and partners as part of their commitment to collective security. The subjects are chosen with the modeller in mind and each article provides both reference and inspiration using authoritative text, 'in-action' photos, and specially commissioned colour profiles. There is also a modelling gallery of some of the best NATO-themed models that have recently appeared in *Military Modelcraft International*.



**M1A2 SEP V2 of 2-5 Cavalry 1st Armored Brigade Combat Team, Zagan, Poland, February 2018.**





A Challenger 2 of The Queen's Dragoon Guards prepares for Exercise Bavarian Charger at the Grafenwoehr Training Area in 2013.  
(Ministry of Defence)

# The Challenger 2

**M P Robinson** provides some background on the United Kingdom's current MBT.

The vehicle we know today as the Challenger 2 was developed as the Chieftain MBT's replacement, and it entered service over fifteen years after the Chieftain's designed replacement date. The reasons for the Chieftain's belated replacement included budget restrictions and the lack of a suitable replacement. British tank design philosophy included the use of a 120mm rifled gun and heavier armour than contemporary European tank designs. The Chieftain's development had taken sixteen years from first specification to production, typical for the time, and it was designed with a service life of twenty years. Because its succession was not given the same priority, there was no smooth transition to a new Main Battle Tank to replace the Chieftain after 1985.

Part of the problem was that future British main battle tank design philosophy in the 1970s lacked focus. It was not for

any lack of expertise; for the British had been the first NATO country to adopt a 120mm main armament and they led the world in armour development. British firms had also perfected advanced night vision equipment, and modern fire control systems. The British had every ingredient for world class battle tank design available from their domestic industries, but lacked firm directives on how best to combine these. One school of thought favoured the development of a completely new MBT design to replace the Chieftain. This encompassed two programmes, the Future Main Battle Tank (FMBT) and Main Battle Tank 80 (MBT80).

These programmes became the single greatest barrier to replacing the Chieftain in a timely manner. While well intentioned, both had an element of co-production with an allied nation and were driven by ponderous committees.



## The Challenger 2



The Shir 2 program was cancelled by Iran in 1979, which forced the British government to buy the Shir 2 as the Challenger MBT. This did not in itself force the cancellation of the MBT80, but it conveniently delayed the replacement of the Chieftain. The MBT80 was cancelled due to cost overruns and the Challenger order was increased. (Tim Neate)



The FV4211 Aluminium Chieftain, which introduced Chobham Armour, was but one of several advanced British MBT projects under development in the late 1960s and early 1970s in the UK. (Keith Paget)



The remains of ATR2, one of two test rigs built from Chieftain and Shir 2 components to test out concepts for the MBT80 program. The MBT80 program was cancelled before any definitive prototypes were built, and this sole vehicle is all that remains of the project. (Keith Paget)



The Vickers Mk.7, a vehicle without any ties to the Centurion-Chieftain-Shir development path. The Mk.7 was a combination of the Leopard 2 hull and the Vickers Universal Turret, which included the Marconi Centaur firecontrol system. Like the Leopard 2 and the M1 Abrams, the Mk.7 had what we call a hunter killer sighting system. The Challenger 2 included a modernised Challenger hull and a turret based on that of the Mk.7.(Vickers)





One of the nine Challenger 2 prototypes, retaining the side plates and tracks employed on the Challenger 1. The turret was a complete departure from that employed on the Challenger 1, mounting the new L30A1 rifled 120mm gun. (Vickers)



An early production Challenger 2 photographed in 1998 at Bovington. The 'bazooka' sideplates worn by three generations of postwar British battle tanks were dropped in favour of removable theater specific armour packages. A double pin track system was also adopted for the first time. The Challenger 2 also mounted a coaxial chain gun and the loader's hatch mounted the GPMG mounted on the commander's cupola on previous designs. These novel features were quickly adapted to by the new tank's enthusiastic crews. (MP Robinson collection)

Naturally the political implications of co-producing a major weapon system made it difficult to advance the design of an actual tank, and the main political aim of sharing production was minimising British development costs. It was all wishful thinking, because the British found themselves without any interested suitors. The Americans, West Germans and French had their own programmes, their own design philosophies and they had no interest in joining the British despite entreaties at the highest levels.

After the FMBT program had evolved into the extremely ambitious MBT80 program, there were technological factors that soon made the program extremely vulnerable to cost

overruns. There were numerous delays in finalizing the specification and the MBT-80 program had become a political morass by the late 1970s. No prototypes had been built and the projected cost of each vehicle grew alarmingly. The projected date for entry into service of the MBT80 slipped further and further into the late 1980s, while new MBTs (with vastly inflated capabilities) flowed in massive numbers from Soviet factories.

A second, more practical trend in British tank design was being undertaken for the export market by Royal Ordnance. Royal Ordnance simultaneously marketed the Chieftain, and they developed the basic Chieftain into a



## The Challenger 2



**A Challenger 2 of The Queen's Royal Lancers after fitting additional armour kits at Camp Coyote, just prior to the beginning of Operation Telic in 2003. The kits worn by these vehicles had been originally procured for the Challenger 1s used in Operation Granby a dozen years previously. (Ministry of Defence)**

much improved design for the Imperial Iranian Army. The ultimate Royal Ordnance MBT proposed to the Iranians was the Shir 2 in the late 1970s. The definitive Shir 2 was driven by a 1200 horsepower Rolls-Royce diesel and featured a hydro-pneumatic suspension. It employed a welded armour steel turret and hull, with revolutionary Chobham composite armour protecting its frontal arc. In the same period Vickers marketed their 37-ton Vickers Medium Tank (a simple MBT design already licence produced in India) to African armies and Kuwait. It also had plans on the drawing board to develop advanced MBT turrets which evolved from 1974 into types that could be fitted with different armour configurations and eventually with rifled and smoothbore 120mm guns.

In essence, the Shir 2 rectified the Chieftain's low power-to-weight ratio and offered far better armour protection while keeping within the Chieftain's other basic design parameters. In 1979, Royal Ordnance had started to produce the Shir series for the Iranians and had invested heavily enough to face disaster once the Ayatollah came to power in 1979, cancelling all of the Iranian orders. The government began to examine the possibility of buying Shir 2s while the MBT80 project approached the stage where prototypes were being planned. The Shir 2 cost about 40% less per vehicle than the projected unit cost of buying the MBT80. The MBT80 was cancelled in 1980, still only a paper project- largely because it was expected to begin production after 1989. The Shir 2



**Many efforts were made to showcase the Challenger 2 in hopes of selling the tank to friendly armies. This Challenger 2 is being shown off to a foreign delegation at Sennelager. (Lawrence Skuse)**



**One of the export configurations proposed for the Challenger 2E. The Challenger 2E incorporated the Leopard 2's engine and transmission and several variations in the types of commander's panoramic sights and gunner's primary sights were available while the tank was marketed. (J.W De Boer)**



was adopted as the Challenger, first issued in 1983, and while over 400 were eventually ordered, this tank was intended to supplement (and not replace) the Chieftain.

Vickers went on to develop its turrets for the experimental Valiant MBT, the Osorio MBT and, in conjunction with Krauss-Maffei, for the Vickers Mk.7 MBT. These vehicles had no shared lineage with the Chieftain- Shir 2 development line and made ready use of foreign components (especially in the advanced fire controls offered with the Vickers Mk.7 in 1985). The RAC's Armoured Development and Trials Unit at Bovington provided crews to Vickers as they marketed the vehicle in trials in Egypt and elsewhere in the Middle East and the RAC's senior officers were aware of the Mk.7's excellent ergonomics and fire controls.

The Challenger was not as advanced as contemporary designs like the M1 and the Leopard 2A4, largely because it retained a fire control system based on that of the Chieftain Mk.5. The army recognized this factor and formally reaffirmed its requirement for a Chieftain replacement in November 1986. Because Royal Ordnance and the British government wanted to sell the existing Challenger abroad, this factor was not publicized. The Royal Armoured Corps took the Challenger to the Canadian Army Trophy competition in 1987. Its performance in the hands of the Royal Hussars teams at CAT 87 was poor enough to discredit the new tank (and by extension British tank design), causing a political scandal. The Royal Armoured Corps' need for a new MBT design was thereafter given a higher priority, which coincided with Vickers acquisition of Royal Ordnance in 1986.

Vickers' combination of the Mk.7 MBT's turret and the Challenger hull in 1988 was the first recognizable step in the Challenger 2's existence. This combination made the most of



**In 1992 the ninth Challenger 2 prototype was extensively marketed in the Middle East, although only Oman placed a production order.** (Dennis Lunn)



**In 2001 the British Army conducted extensive exercises in Oman, known to posterity as Exercise Saif Sarrea II. The lessons learnt were implemented in time for the Challenger 2's baptism of fire in 2003.** (Ministry of Defence)



**A Challenger 2 of A Squadron, 1st Royal Tank Regiment on exercise in 2005. The 1st RTR's A Squadron often undertook OPFOR duties and demonstration duties on Salisbury Plain until the final amalgamation of the 1st and 2nd RTR into The Royal Tank Regiment in 2016.** (Lawrence Skuse)



## The Challenger 2



The Challenger 2E was marketed again in 1998 in the Hellenic Army MBT trial, where it lost out to the Leopard 2A5. In 2005 the Challenger 2E ceased to be offered by BAe, which had by then absorbed Alvis-Vickers. (Dennis Lunn)



Nomad, The Royal Tank Regiment's commanding officer's tank, was seen in an overall black paint scheme on the occasion of the amalgamation of the 1st and 2nd Royal Tank Regiments. (Marylin Suckling Gear)

two already proven elements, promising a quick development path. The hull was structurally very similar to that inherited from the old Shir 2 design, but the transmission, suspension and ammunition stowage differed entirely in the new MBT. The CV12 engine was retained, and the new MBT design enjoyed considerably better mobility. Many of the new hull components had been refined during Vickers' development of the CRARRV recovery vehicle then being ordered to replace the Chieftain ARRV. The Vickers MBT would also carry a new generation of Chobham armour, providing even better protection than that already enjoyed by the Challenger.

Prime Minister Thatcher had no intention of adopting a

foreign design, and the Vickers design enjoyed a certain degree of tacit support at the highest levels. The lobby within the government and within the army who supported the possibility of adopting a West German or American MBT and the Rheinmetal 120mm smoothbore would not be dismissed however. During the tumultuous course of 1989 the new MBT requirement was solidified into a formal General Staff Requirement and it was resolved to run a comparative trial between the new Vickers Tank and the latest MBT designs from the USA, Germany and France.

The process of qualifying a new MBT was no simple matter and it took over a year to implement a comparative trial,

A Trojan Armoured Vehicle Royal Engineers photographed on operations in Helmand Province, Afghanistan. Notice the full width mine plough, the fascine and the Chobham armour appliqué packs and bar armour. (Ministry of Defence)







The Challenger 2

**A Challenger 2 of the Royal Tank Regiment fires a practice round at the Castlemartin Ranges in 2013.** (Ministry of Defence)



**One of the most visible additions to the Challenger 2's weaponry in light of combat experience in Iraq was the adoption of the Remote Weapon System, which can be fitted with 7.62mm GPMG, .50 caliber HMG and 40mm grenade launcher options.** (Colin Rosenwould)



**The Titan Armoured Vehicle Launched Bridge is the second Challenger 2 variant operated by the Royal Engineers.** (Ministry of Defence)

which was then delayed repeatedly by the uncertainty of the strategic situation in Western Europe, the consequent prospect of a smaller MBT order and by the now slower evolution of the Vickers design and of contenders like the new GIAT MBT. Then in late 1990 the situation in the Middle East and particularly in Saddam Hussein's Iraq caused a wholesale crisis as Kuwait was invaded. The new MBT selection program, and particularly the evaluation of the foreign MBTs, was disrupted and delayed. The British government decided to supply a complete armoured brigade in the event of military action, augmented quickly to include the 1st Armoured Division with a complete logistic tail, and substantial RAF and Royal Navy support. Known as Desert Storm to the Americans, the British knew the liberation of Kuwait as Operation Granby.

The Challenger did not fail in its desert mission as many sensationalist press articles warned. In fact the Challenger did extremely well as a combat vehicle, and redeemed a reputation sullied in the CAT 87 competition with feats of long range gunnery (which only solidified the Royal Armoured Corps' position on the requirement for a rifled 120mm gun for their next MBT). General reliability was excellent, and Vickers won accolades for bringing the CRARRV recovery



**Wearing a Mobile Camouflage System over its Theatre Entry Standard armour kits, the Challenger 2 seen here weighs in around 72 tons. The Challenger 2's engine and transmission have proven consistently up to the task of bearing additional weight.** (Ministry of Defence)



## The Challenger 2

A Challenger 2 of the Queen's Royal Hussars during Exercise Bergen Hohne in 2016, a preparation for their deployment to BATUS later in the year. (Ministry of Defence)



Challenger 2s are moved from 7th Armoured Brigade, based at Hohne, to the 20th Armoured Brigade in Sennelager to begin familiarisation training in 2012. (Ministry of Defence)



A Queen's Royal Hussars Challenger 2 manoeuvres on the Hohne Ranges in Germany in 2012. (Ministry of Defence)





## The Challenger 2

### Challenger 2 in Service

The Challenger 2 has enjoyed a fine reputation as a reliable and effective combat proven design. It was blooded in Operation Telic in 2003 and its firepower, battlefield mobility and armour has again proven the British design philosophy embodied since the Centurion took to the battlefield in Korea in 1950. Challenger 2s have proven as durable as the American Abrams, with some surviving direct hits from repeated ATGM strikes and dozens of RPG hits. The L30A1 gun has an indirect fire range of 5km and has performed comparably in the anti-armour role to the 120mm smoothbore guns that equipped the MBTs of Germany, America and France.

The Challenger 2 currently equips the Regular Army units of the Royal Armoured Corps: the Royal Tank Regiment (1st Armoured Infantry Brigade); the King's Royal Hussars (12th Armoured Infantry Brigade); and the Queen's Royal Hussars (Queen's Own and Royal Irish) (20th Armoured Infantry Brigade). The Royal Wessex Yeomanry, a Territorial Army unit, supplies replacement crews. Currently there are 227 Challengers in service (with 59 used for training and reserves, including those permanently stationed at BATUS). In 2020 the King's Royal Hussars will exchange their Challenger 2s for the new Ajax (Scout SV) vehicle and, along with the Household Cavalry form the first British Army 'Strike Brigade'.



**A Challenger 2 at the British Army Training Unit Suffield (BATUS) in Canada during Exercise Prairie Storm in 2015. Prairie Storm 2015 saw the Royal Tank Regiment train alongside the 1st Battalion, the Royal Fusiliers, in a battlegroup-sized field exercise.** (Ministry of Defence)

vehicle into service months ahead of schedule and directly off the Newcastle production line. If any one factor positioned Vickers favourably in 1991 versus foreign competitors it was the competent manner in which the support of the Challenger 1 fleet was managed by Vickers during Operation Granby. The decision to adopt the Vickers MBT as the Challenger 2 was announced in June 1991, initially as a supplement to the Challenger. The original order for 127 MBTs was preceded by the construction of nine prototypes.

The Challenger 2 prototypes received much exposure in hopes of selling the design abroad, an effort which failed to live up to expectations. The first regiment equipped with the Challenger 2 was expected to be the Royal Scots Dragoon Guards, and it fell to them as well as the ADTU at Bovington to conduct a substantial number of the trials. Delays related to reliability requirements pushed equipment of the SCOTS DG out to 1998, by which time the order had been increased to 386 MBTs as a full replacement for the Challenger 1 (the Chieftain having been retired in 1994-1995).



**In September 2016 Challenger 2s from the Queen's Royal Hussars took part in Exercise Venerable Gauntlet alongside Estonian troops at the Sennelager Ranges in Germany.** (Ministry of Defence)





# M1 Abrams Today

**David Grummitt** looks at how the United States' Main Battle Tank is meeting the challenges of today.





(U.S. Army by Spc. Andrew McNeil)

In the last few years, and especially since the war in Ukraine in 2014-15, the United States warfighting strategy has moved away from counter-insurgency and hybrid warfare to facing peer or near-peer competitors on the battlefield. These move away from Low Intensity Combat (LIC) situations has necessitated a renewed emphasis on Combined Arms Manoeuvre (CAM) and the type of heavy weapons platforms, especially the Main Battle Tank, that were typical of the Cold War period. Central to this doctrine, of course, is the M1 Abrams MBT, alongside the M2/M3 Bradley and the M109A6



A heavily weathered M1A1 of 4th Cavalry Regiment in Iraq, 2004. (U.S. Army).



Another M1A2 SEP V2 during a joint combined arms live-fire exercise near Camp Buehring, Kuwait December 2016. (U.S. Army by Sgt. Aaron Ellerman)

self-propelled howitzer. This month's Armour in Profile looks at the M1 Abrams in service today, both with the U.S. Army and USMC, as well as with other nations.

### From Baghdad to the Baltic

The M1 Abrams played a crucial part in the Coalition's victory over the forces of Saddam Hussein as part of Operation Iraqi Freedom in 2003, just as it had done in the First Gulf War twelve years previously. As part of the doctrine of 'Shock and Awe' Abrams from both the U.S. Army and the USMC were at the forefront of the invasion which began on 20 March. On 9 April Baghdad fell after the famous 'Thunder Run', led by Abrams of 64 Armor Regiment, 3 Infantry Division. The Abrams proved itself a formidable opponent and a combination of poor training, equipment and tactical employment ensured the Iraqi regular army and Republican Guard was no match for the Coalition armour. Soon after, however, the nature of the conflict changed. Although President Bush had famously proclaimed "Mission Accomplished" on 1 May 2003, insurgent attacks upon the Coalition forces began to increase leading to the



## M1 Abrams Today



**An M1A2 SEP V2 of 3-69 Armor Regiment, 1st ABCT (Armored Brigade Combat Team), 3rd Infantry Division taking part in Operation Iron Sword, November 2015, in Lithuania. This was part of Operation Atlantic Resolve. Note the RAL6031 paint covering the CARC Tan and the M88A2 ARV following behind.** (U.S. Army by Staff Sgt. Michael Behlin)



**Boresighting M1A2 SEP V2 tanks of 116th ABCT, another National Guard unit, at the Orchard Training Center, Boise, Idaho.** (U.S. Army by Maj. Wayne (Chris) Clyne)



**A heavily camouflaged M1A2 SEP V2 of 1-98 Cavalry Regiment, 155th ABCT. This tank from the Mississippi National Guard was photographed at the National Training Center, Fort Irwin, California in May 2017** (U.S. Army by Staff Sgt. Shane Hamann)

bloody two battles of Fallujah in April and November 2004. By March 2005 some eighty Abrams had been disabled by Iraqi regular forces and insurgents, the vast majority by the latter employing IEDs (Improvised Explosive Devices).

Heavy armour played a crucial role in the U.S. counter-insurgency operation. The Abrams provided both a heavily protected platform, minimising casualties, and an effective means of delivering concentrated, precision firepower on the insurgents. Two developments to the Abrams during this period demonstrate the tank's successful deployment in LIC.

The new M1028 120 mm anti-personnel canister cartridge contained over a thousand 3/8-inch (9.5 mm) tungsten balls, producing a shotgun effect lethal out to 600m. The round was employed both as an anti-infantry weapon, but also to destroy concrete buildings. The second innovation was the TUSK (Tank Urban Survival Kit), a series of field-installed Reactive Armour tiles, passive armour belly protection, and (initially at least) slat armour designed to counter IEDs, RPGs and other insurgent tactics. The kit also included enhanced protection for the commander and loader, allowing them to observe





M1A2s of 1-68 Armor Regiment, 3rd ABCT, 4th Infantry Division at the Karlikie Range in Zagan, Poland, January 2017. Note that this SEP V2 does not have the CROWS II installed. (U.S. Army by Staff Sgt. Corinna Baltos)



Tanks of the same unit take up firing positions during a combined arms live-fire exercise at the 7th Army Training Command's Grafenwoehr Training Area in Germany, July 2017. (U.S. Army by Gertrud Zach)



Soldiers from 1-18h Infantry Regiment, 2nd ABCT, 1st Infantry Division, dismount an M1A2 SEP V2 Abrams tank during training in December 2017 at Smârdan Training Area, Romania. (U.S. Army by Pfc. Shelton Smith)



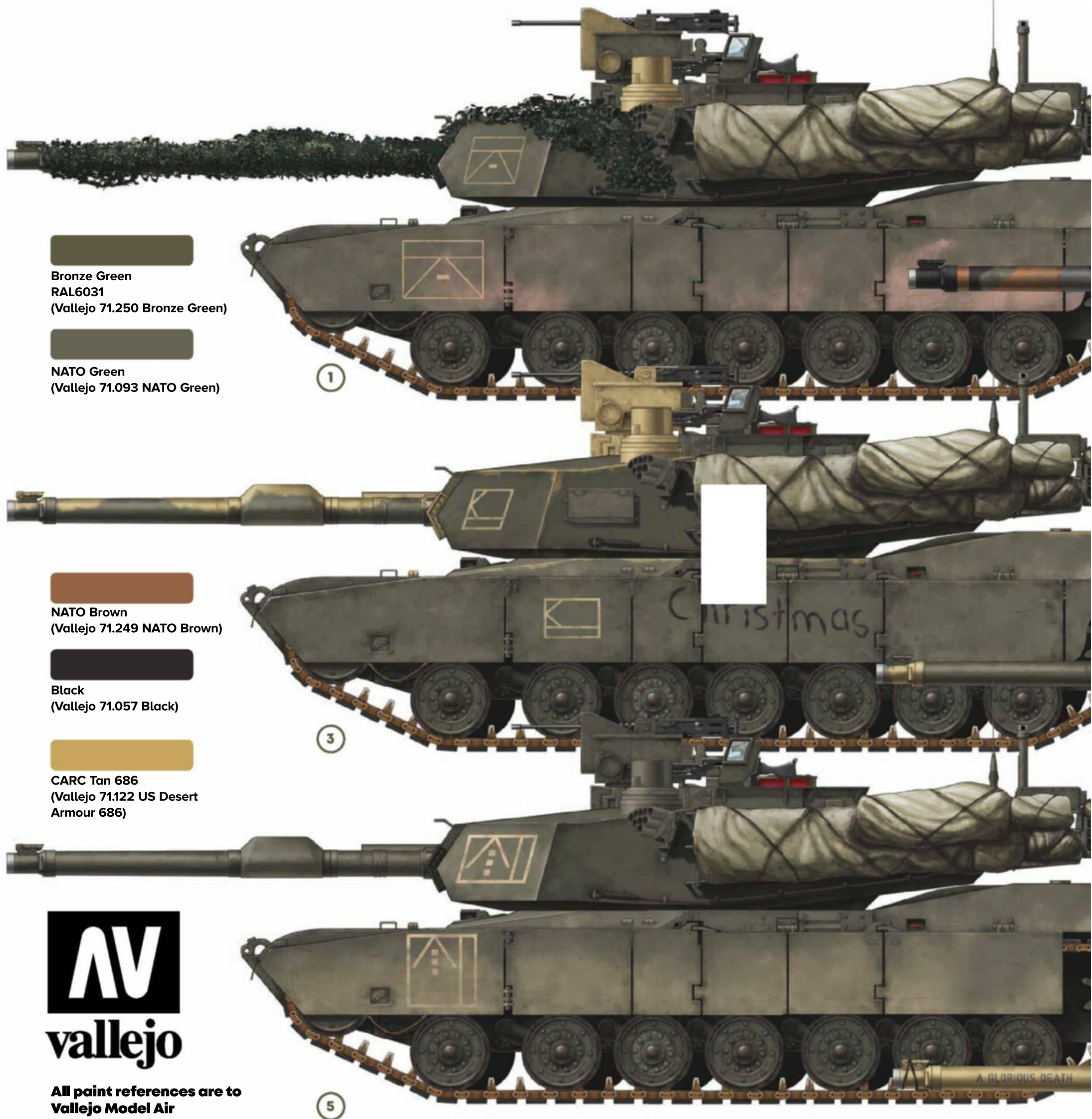
Soldiers assigned to the same unit prepare a M1A2 SEP V2 Abrams to be off loaded from a rail car in Parsberg, Germany January 2018 following their return from the Smârdan Training Area in Romania. (U.S. Army by Pfc. Shelton)

2nd ABCT returned to Smârdan in April this year for 'Justice Eagle', a bilateral live-fire exercise with the Romanian 282nd Mechanized Infantry Brigade. Note the faded 'Tiger Stripes' whitewash applied over the Bronze Green finish. (U.S. Army by Staff Sgt. Matthew Keeler)





## M1 Abrams Today



- 3** M1A2 SEPv2 Abrams, 1st Battalion, 18th Infantry Regiment, 2nd Armoured Brigade Combat Team, 1st Infantry Division, during training at the Smardan Training Area, Romania, December 2017. Overall Bronze Green RAL6031 (Vallejo 71.250 Bronze Green). Areas of the vehicle have been left in CARC Tan 686 (Vallejo 71.122 US Desert Armour 686), along with the vehicle markings. Note the graffiti.
- 4** M1A2 SEPv2, C Company, 1st Battalion, 18th Infantry Regiment, 2nd Armoured Brigade Combat Team, 1st Infantry Division, during Exercise Justice Eagle, Smardan, Romania, April 2018. Overall Bronze Green RAL6031 (Vallejo 71.250 Bronze Green), with disruptive camouflage in White (Vallejo 71.001).
- 5** M1A2 SEPv2 Abrams, 2nd Armoured Brigade Combat Team, 1st Infantry Division, during Live Fire Exercise Combined Resolve X, Grafenwoehr, Germany, April 2018. Overall Bronze Green RAL6031 (Vallejo 71.250 Bronze Green). All markings are left in CARC Tan 686 (Vallejo 71.122 US Desert Armour 686).
- 6** M1A2 Abrams, A Glorious Death, Karlikie Range, Zagan, Poland, January 2017. Overall CARC Tan 686 (Vallejo 71.122 US Desert Armour 686). All markings are in Black.



- ① **M1A2 SEPv2 Abrams, 1st Platoon, A company, 2nd Armoured Brigade, 1st Infantry Division, Exercise Allied Spirit, Hohenfels Training Area, Germany 2017.** Overall Bronze Green RAL6031 (Vallejo 71.250 Bronze Green) with components in CARC Tan 686 (Vallejo 71.122 US Desert Armour 686). All markings are in CARC Tan 686 (Vallejo 71.122 US Desert Armour 686).
- ② **M1A1 Abrams, 1st Platoon, B Company, 2nd Tank Battalion, Marine Corps Base Camp Lejeune, North Carolina, 2016.** NATO Green (Vallejo 71.093 NATO Green), NATO Black (Vallejo 71.057 Black) and NATO Brown (Vallejo 71.249 NATO Brown). Markings are in Black and CARC Tan 686 (Vallejo 71.122 US Desert Armour 686).





## M1 Abrams Today



**Abrams tanks of Alpha Company, 1-63 Armor Regiment,, 2nd ABCT, 1st Infantry Division perform a strategic convoy maneuver during 'Combined Resolve X' at the Hohenfels Training Area on 2 May 2018. This was the first brigade-sized road march by U.S. forces that has taken place in Germany since the end of the Cold War** (U.S. Army photo by Spc. Andrew McNeil)

the battlefield behind armoured glass and a second coaxial 12.7mm M2HB machine gun mounted directly above the main gun and fired remotely. By 2008 550 TUSK packages had been delivered and they proved successful in Iraq.

The experience of war in Iraq and Afghanistan led to a debate within the U.S. military over the future of the Main Battle Tank. In a world of budgetary constraints following the 2009 Financial Crisis and where it was believed in some circles that the fundamental nature of warfare had changed, a school of thought argued that the MBT was redundant and that wars in the future would be waged through UAVs (Unmanned Aerial Vehicles), long-range ballistic ordnance, special forces and an increased use of electronic warfare. The last remaining U.S. armoured units were withdrawn from Germany in 2013. The Abrams was a relic of the Cold War and production should be scaled down. Indeed, it was planned to

end production at the Lima Army Tank Factory from 2013 to 2016.

The Ukraine crisis of 2014 and the Russian annexation of Crimea changed the geopolitical situation and forced the U.S. to reassess its warfighting capabilities. Concern among the United States' northern and central European NATO partners led to Operation Atlantic Resolve, a U.S.-led NATO effort to assure Russia's nearest neighbours, and particularly the Baltic States, of NATO's continuing commitment to their defence. From 2015, as part of the European Reassurance Initiative, until its redeployment to the U.S. in September 2017, 3rd Armored Brigade Combat Team, 4th Infantry Division, with 87 M1A2 Abrams, stationed in Germany demonstrated the United States' commitment to European security and took part in NATO exercises from Estonia to Bulgaria. These exercises marked a renewed emphasis on CAM and tactical co-operation between NATO partners as part of a wider reorientation of the mission of the U.S. armoured force.

### **The M1 Abrams in Service Today**

The U.S. Army: The US army today operates two variants of the M1 Abrams. The M1A2 SEP V2 is the standard MBT of the regular U.S. Army and one currently deployed with Armored Brigade Combat Teams in the United States, Germany and South Korea. The SEP (Systems Enhancement Package) V2 has a number of systems upgrades over the M1A2 SEPs that saw service in Iraq, but the most notable external difference is the XM153 CROWS II (Common Remote Operated Weapons System) for the commanders' M2HB MG. The National Guard armoured battalions also operate the M1A1 SA (Situational Awareness). These refurbished M1A1s have the same basic upgrades as the earlier M1A1 AIM (Abrams Integrated Management), which included the 'Blue Force Tracker' (for



**A M1A2 SEP V2 of, 1-63 Armor Regiment, 2nd ABCT, 1st Infantry Division during the 'Combined Resolve X' live-fire exercise on 19 April 2018 at Grafenwoehr, Germany.** (U.S. Army by Spc. Dustin D. Biven)





**An M1A1 FEP (Firepower Enhancement Packet) of 2nd Tank Battalion, United States Marine Corps, near the Norwegian town of Hjerkind in November 2018 during Exercise Trident Juncture 18. (USMC photo by LCpl. Menelik Collins)**



**M1A2 SEP V2s of 2-5 Cavalry, 1st ABCT, take part in Exercise Combined Resolve XI at the Grafenwoehr Training Area in January 2019. Note these tanks are not fitted with the CROWS Remote Weapon System. (U.S. Army photo by Gertrud Zach)**

digitally tracking friendly forces), power train improvements and 'Heavy Armour' (steel-encased depleted uranium), but also have a new laser rangefinder, gunner's site and SCWS (Stabilized Commander's Weapon Station).

The U.S. Army's Abrams are deployed across ten Armored Brigade Combat Teams (ABCT), with a further five National Guard ABCTs. Each ABCT has a nominal strength of 90 tanks and contain two armored battalions (two tank companies and a mechanized infantry company) and two mechanized infantry battalions (one tank company and two mechanized infantry companies). In October 2015 the U.S. Army unveiled its M1A2 SEP V3 tank. Most of the changes are internal and electronic, although the V3 will include a new low profile CROWS Remote



**An M1A2 SEP V2 of 1-37 Armor Regiment, 2nd ABCT, trains during Exercise Strike Focus held at Orogande Range Camp in the New Mexico Desert in April 2019. (U.S. Army photo by Spc. Matthew J. Marcellus)**



**An M1A2 SEP V3 prototype at the Yuma Proving Ground in Arizona in the summer of 2019. The additional weights on the glacis plate and turret simulate the additional armour packages that will be fitted to the M1A2 SEP V3. (U.S. Army photo by Ana Henderson)**

Weapons Station (now fitted as standard to the SEP V2) and a small exhaust for the generator which powers the fighting compartment without running the main engine. The first four tanks were accepted into service in October last year and it is envisaged that it will begin to replace the SEP V2 during 2020. There can be little doubt that the latest Abrams iteration is designed to counter new Russian platforms such as the T-14 Armata. As Major General David Bassett, executive officer for Ground Combat Systems, remarked, "These vehicles are not just about assuring our allies, or deterring or coercing potential adversaries, they are about compelling our enemies and winning the multi-domain battle."

United States Marine Corps: the USMC currently has some



## M1 Abrams Today



The U.S. Army's newest Abrams unit 6-1 Cavalry Regiment, 1st ABCT, conduct their first live-fire accuracy screening exercise with the M1A2 SEP V2 at Fort Bliss, Texas, in October 2019. (U.S. Army photo by Staff Sgt. Kris Bonet)



Soldiers from Company C, 1-18th Infantry Regiment, 2nd ABCT, 1st Infantry Division, load a M1A2 SEP V2 with 120mm multipurpose tracer rounds at Smârdan Training Area in April 2018. This images provides a good close-up of the CROWS II (U.S. Army by Staff Sgt. Matthew Keeler)



An M1A2 SEP V2 of 3-66 Armor, 1st ABCT, waits on the Grafenwoehr Training Area in August 2019 just before the start of Exercise Combined Resolve XII. Note the LP (Low Profile) CROWS Remote Weapons Station. This is now standard on U.S. Army M1A2s. (U.S. Army photo by Staff Sgt. Adam Decker)

120 M1A1s in service across its three (one a reserve) tank battalions. The role of the Marine Corps' Abrams is to close with and destroy the enemy using expeditionary armour-protected firepower, shock effect, and maneuver in support of the MAGTF (Marine Air-Ground Task Forces) across the range of military operations. The two active battalions currently serve as part of the I and II Marine Expeditionary Forces, based at Camp Pendleton, CA, and Camp Lejeune, NC, respectively.

### The Future

As the experience of armoured warfare in the Syrian conflict, in Israel's recent operations in the Gaza Strip and during the

second Lebanon War (2006), and in Saudi Arabia's war in Yemen has shown, the greatest threat to modern MBTs is the ATGM. In February 2019 the U.S. Army announced it had purchased the Trophy Active Protection System (as fitted to the Israeli Merkava Mk. 4M). 261 units have been purchased, to be fitted over the next year or so, enough to equip three ABCTs. This is further evidence of the United States' reorientation towards peer-on-peer conflict. In the longer term the upgrade to SEP V3 standard has been approved and beyond there the M1A3 concept is still live. Whatever happens, the U.S. Army expects the M1 Abrams to serve for another two decades at least.



Men of the Washington National Guard in their M1126 Infantry Carrier Vehicle (ICV) in April 2019. (U.S. Army photo by Sara Morris)



# Stryker Interim Combat Vehicle

**David Grummitt** examines the U.S. Army's wheeled combat vehicle.

In 1999 the United States deployed Task Force Hawk, a combined arms force equipped with Abrams, Bradleys and other heavy equipment, from their bases in Germany to help with the NATO mission to bring peace and stability to Kosovo. The deployment proved something of a logistical disaster, prompting the then American ambassador to the United Nations, Madeline Albright, to ask "What's the use of having the world's best military when you don't get to use them?" With the end of the Cold War and the rise of a new international security situation, it is was clear that the U.S. Army's heavy forces were insufficient to meet the fast-changing demands of future combat. In other words, the U.S. Army needed to be able to deploy quickly, by air, and make its presence felt both militarily and politically at short notice.



A soldier assigned to the 2nd Stryker Brigade Combat Team, 2nd Infantry Division fires at opposing forces aircraft with his M2 machine gun atop a M1126 ICV Stryker at Fort Polk, Louisiana, in February 2018. (U.S. Army photo by Staff Sgt. Armando R Limon)



Stryker Interim Combat Vehicle



A M1126 ICV of 1st Battalion, 23rd Infantry Regiment, 3rd Brigade, 2nd Infantry Division at Forward Operating Base Marez during Operation Mayfield IIII at Qabr Abd, south of Mosul, in July 2004. (NARA: Spc Aaron Ritter)



A M1126 ICV of 1st Battalion, 5th Infantry Regiment, 25th Infantry Division near Mosul in March 2005. Note the sandbags, slat armour and other additional protection and equipment typical of Strykers serving in Iraq. (NARA: TSgt. Mike Buytas)



Strykers of 2nd Squadron, 2nd Cavalry Regiment during Live Fire Exercises at the Grafenwoehr Training Centre in March 2012. (U.S. Army by Staff Sgt. Jose Ibarra)



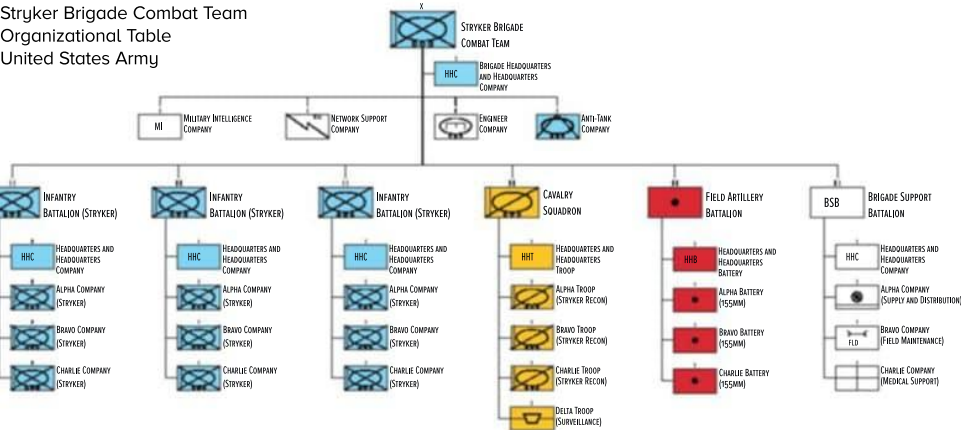
A M1126 ICV of 4th Squadron, 2nd Cavalry Regiment on exercise at the the Drawsko Pomorskie Training Area in Poland in September 2015 in support of Operation Atlantic Resolve. (U.S. Army photo by Spc. Marcus Floyd)

In June 1999 General Eric K. Shinseki was appointed as the U.S. Army Chief of Staff and tasked with transforming American military power for the 21st century. MBTs and Bradley Fighting Vehicles still had their place, but alongside this ‘Legacy Force’ there was a clear need for an ‘Interim Force’, designed to deploy force rapidly, that would suffice until the U.S. Army was transformed with the advent of the air-deployable Future Combat System. The aim was to deploy a brigade combat team anywhere in the world in 96 hours and a full division with 120 hours. Although the Future Combat Systems program was

controversially cancelled in 2009, the legacy of the ‘Interim Force’ lives on in the form of the Stryker Interim Armored Vehicle (IAV) and the Stryker Brigade Combat Team. The IAV, originally named the Medium Armored Vehicle, was not designed to replace any existing AFV in the U.S. inventory, but was intended to fulfil a role between that of the HMMWV and the Abrams and Bradley.

The Stryker Interim Combat Vehicle

The choice of an armoured vehicle to equip the new brigade was constrained by the decision to purchase an already existing vehicle and modify it accordingly to U.S. Army purposes. In November 2000 the controversial decision was taken to adopt the 8X8 LAV III, built by General Motors of Canada and General Dynamics Land Systems Division. The LAV III was, in turn, a version of the MOWAG (part of General Dynamics European subsidiary) Piranha, which already formed the basis of the U.S. Marine Corps LAV (Light Armored Vehicle). The LAV III was larger, however, and had gained a reputation for reliability while serving with the Canadian army. In February 2002 the new vehicle was officially named the Stryker after two posthumous Medal of Honor winners: Pfc. Stuart Stryker of 13th Airborne Division in World II and



An organisational chart of an infantry-regiment based Stryker Brigade Combat Team.



Specialist 4 Robert Stryker of 1st Infantry Division who had been killed in Vietnam. The Army placed an initial order for 2,131 Strykers, at a cost of \$4 billion.

Currently the U.S. Army fields seven Stryker Brigade Combat Teams (SBCT), with two other National Guard SBCTs. Each SBCT is comprised of three infantry battalions (or squadrons in a cavalry regiment-based SBCT), a cavalry squadron, field artillery battalion (armed with 155mm M777A2 howitzers), a brigade support and a brigade engineer battalion. Each brigade has some 300 Strykers and 4,500 personnel. One brigade (2nd Cavalry Regiment) is based in Vilseck, Germany, while the remaining SBCTs are based in the United States.

### Stryker Variants

The standard Stryker is an 8x8 vehicle with steel armour, sufficient to withstand 14.5mm armour-piercing rounds, and a series of ceramic add-on armour pieces. It can also be fitted with anti-RPG slat armour. The vehicle in its M1126 configuration weighs a little over 18 tons, allowing it to be air deployed from a C-130H cargo plane. It has a top speed of 62.5mph on roads and a maximum operational range of some 300 miles, far better than any tracked vehicle. One of the primary requirements of the IAV program was connectivity on



**A M1126 ICV of 1st Squadron, 2nd Cavalry Regiment during Exercise Sabre Strike in Poland in June 2018. Note its M151 Protector RWS is fitted with the MK19 40x53mm automatic grenade launcher.** (U.S. Army photo by Spc. Robert Douglas)



**Strykers of 1st Battalion, 5th Infantry Regiment, 1st Stryker Brigade Combat Team, 25th Infantry Division, on exercise in Alaska in February 2018.** (U.S. Air Force photo by Justin Connaher)

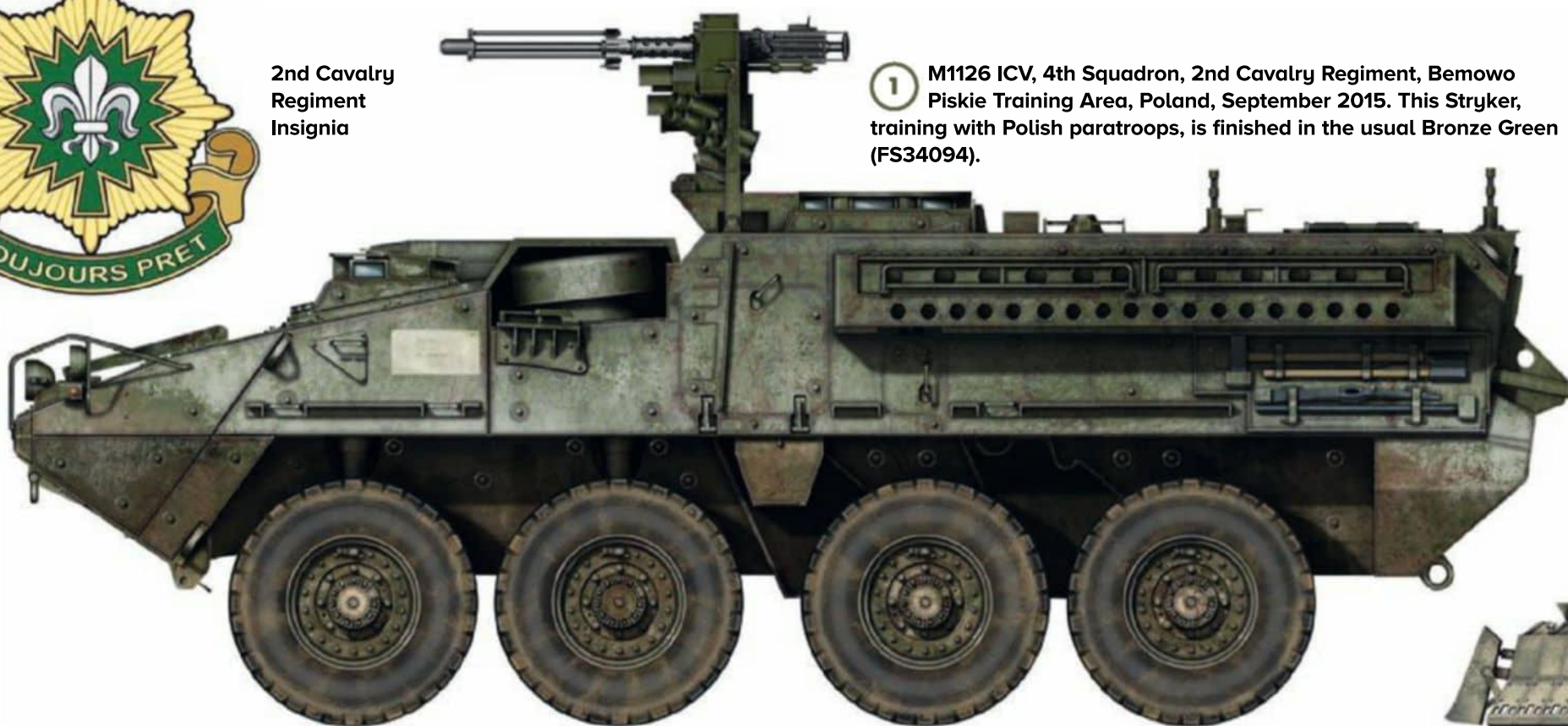


## Stryker Interim Combat Vehicle



2nd Cavalry  
Regiment  
Insignia

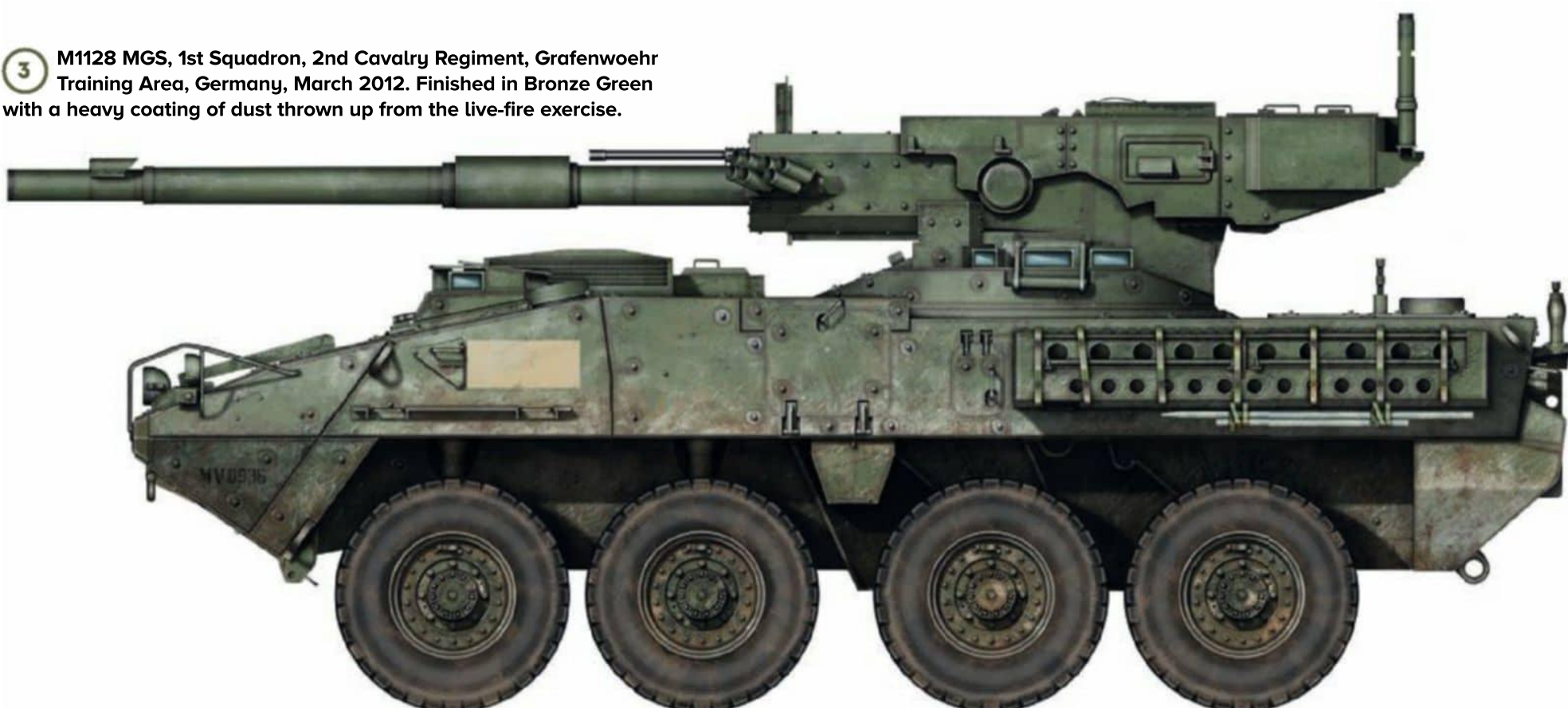
1 M1126 ICV, 4th Squadron, 2nd Cavalry Regiment, Bemowo Piskie Training Area, Poland, September 2015. This Stryker, training with Polish paratroops, is finished in the usual Bronze Green (FS34094).



2 M1130 CV, 1st Battalion, 23rd Infantry Regiment, Tal Afar, Iraq, September 2004. Another Bronze Green Stryker, this time with the slat armour that was fitted as standard to vehicles in Iraq.



3 M1128 MGS, 1st Squadron, 2nd Cavalry Regiment, Grafenwoehr Training Area, Germany, March 2012. Finished in Bronze Green with a heavy coating of dust thrown up from the live-fire exercise.





## Stryker Interim Combat Vehicle

4 M1132 ESV, 1st Squadron, 2nd Cavalry Regiment, Task Force Dragoon, Zangabad, Afghanistan, July 2013. This 2 Cav Stryker is fitted with a Pearson Mine Roller and an improvised camouflage net sun shelter.



5 M1296 ICV Dragoon, 2nd Cavalry Regiment, Stara Boreslav, Czech Republic, May 2018. This was one of the first times the Stryker Dragoon was displayed in public with the new turret uncovered. Like all Strykers, it is finished in Bronze Green.



(U.S. Army photo by Spc. Marcus Floyd)



(NARA: Sgt. Jeremiah Johnson)



(U.S. Army photo by Sgt. Jose Ibarra)



(U.S. Army photo by Spc. Joshua Edwards)



(U.S. Army by Sgt. Timothy Hamlin)

**All paint references are to Vallejo Model Air**

For more details on Vallejo's range of colours, please visit their website [www.acrylicosvallejo.com](http://www.acrylicosvallejo.com)

**Bronze Green –  
Bronze Green 71.250**





## Stryker Interim Combat Vehicle

the digital battleground and the latest upgrade to the Stryker fleet has enhanced this capability even further. Several variants of the Stryker have been developed to perform specific tactical roles in the SBCT.

**M1126 Stryker Infantry Carrier Vehicle (ICV):** this is the standard Stryker variant and carries a nine-man infantry squad, alongside the two-man vehicle crew. It is equipped with the M151 Protector Remote Weapon System (RWS), armed with either the .50cal M2HB Machine Gun or the 40mm Mk19 Mod 3 Automatic Grenade Launcher. Each SBCT has 108 ICVs.

**M1127 Stryker Reconnaissance Vehicle (RV):** this has a crew of five and mounts a Long-Range Advanced Scout Surveillance System (LRA3S) pod, alongside the M151 RWS. It serves in the scout platoons and 48 are issued to each SBCT.

**M1128 Stryker Mobile Gun System (MGS):** the MGS mounts the same 105mm gun as the M1 Abrams. It entered service in 2006, three years after the other Stryker variants, but has proved its worth as a 'bunker-buster' in Iraq. It also now gives the SBCT much needed firepower against a prospective near-peer adversary. 27 MGSs serve in each SBCT.

**M1129A1 Stryker Mortar Carrier Version B (MC-B):** the original MC simply carried a M120 120mm mortar in the rear of the ICV, but from 2005 the MC-B entered service carrying the

RMS6L 120mm mortar on a 360 degree turntable in the rear of the vehicle. The MC-Bs at company level also carry a 60mm mortar for dismounted use, while the battalion-level vehicles have an 81mm mortar instead. Each SBCT has 36 MC-Bs.

**M1130 Stryker Command Vehicle (CV):** the CV is issued to battalion and brigade commanders, as well as to reconnaissance troops. It carries a crew of two and four passengers, as well as a range of communications, command and control systems. 25 are issued to each SBCT.

**M1131 Stryker Fire Support Vehicle (FSV):** the M1131 is issued to the SBCT's reconnaissance squadron and is used to acquire targets for the brigade's mortar and artillery elements. It is equipped with a Fire Support Sensor System, thermal imager, laser rangefinder and laser locator designator for smart munitions. Twelve serve with each SBCT.

**M1132 Stryker Engineer Squad Vehicle (ESV):** the ESV serves to clear obstacles and mine fields and can be fitted with a straight engineer dozer blade, the v-shaped mine clearing blade or a Pearson mine roller. Nine serve in each SBCT.

**M1133 Stryker Medical Evacuation Vehicle (MEV):** the MEV is unarmed and issued to battalions and companies in the SBCT to safely evacuate wounded. Each SBCT has sixteen such vehicles.



A gunner in a M1127 Stryker Reconnaissance Vehicle (RV) of 5th Squadron, 1st Cavalry Regiment, 1st Stryker Brigade Combat Team, lines up his target while his unit and U.S. Air Force Air National Guard Joint Terminal Attack Controllers train together at Yukon Training Area, Alaska, in August 2014. (U.S. Air Force photo by Justin Connaher)



A M1127 Stryker RV from 4th Squadron, 2nd Cavalry Regiment moves on a raft after crossing the Neman River, near Kaunas, Lithuania, in June 2018 during Exercise Sabre Strike 18. (U.S. Army by 2nd Lt. Clay Harman)



A M1128 Mobile Gun System (MGS) awaits transport to Afghanistan to support Operation Enduring Freedom somewhere in south-west Asia in May 2010. (U.S. Army photo by Sgt. David Nunn)



A M1128 MGS of 2nd Cavalry Regiment sends a round down range at the Grafenwoehr Training Area in August 2011. Note the light-coloured dust, typical of the Bavarian training ground. (U.S. Army photo by Sgt. Gerald Wilson)



## Stryker Interim Combat Vehicle



**A M1128 MGS form 1st Stryker Brigade Combat Team during Exercise Artic Anvil at Fort Greely, Alaska, in March 2016** (U.S. Army photo by Robert Aguilar)



**Men of 3rd Battalion, 21st Infantry Regiment, 1st Stryker Brigade Combat Team, 25th Infantry Division, load ordnance into a RMS6L 120mm mortar system on a M1129 Mortar Carrier Vehicle (MC-B) during exercise Orient Shield 2017 at Camp Fuji, Japan, in September 2017.** (U.S. Navy photo by Mass Communication Specialist 2nd Class Christopher Lange).



**A M1129 MC-B of 2nd Cavalry Regiment, prepares to leave a range at the Bemowo Piskie Training Area, Poland, in June 2017 during Exercise Saber Strike 17.** (U.S. Army photo by Spc. Samuel Brooks)

**M1134 Stryker Anti-Tank Guided Missile Vehicle (ATGMV):** the ATGMV mounts a twin-tubed GDLS remote-operated TOW turret above the centre of the rear compartment. Now that the MGS serves in the SBCT, the complement of ATGMs has been reduced to just nine. The SBCT's anti-tank capability has been greatly enhanced, however, by the recent introduction of the CROWS-J (Common Remote Operated Weapons System – Javelin) to the M1126 fleet.

**M1135 Stryker Nuclear Biological Chemical Reconnaissance Vehicle (NBCRV):** first fielded in 2006, the NBCRV provides the SBCT to identify NBC threats. It contains various chemical agent detector systems, as well as the ability to collect soil

samples and lay tape and flags to designate contaminated areas while in a sealed NBC proof state. Three serve in each SBCT.

As well as these variants, the M1296 Stryker Dragoon ICV has recently entered service with the 2nd Cavalry Regiment. As we'll see later, the plan is to replace half the standard M1126 ICV with the ICV Dragoon and the other half with CROWS-J turreted vehicles in 2 Cav SBCT.

### **In Service**

From its inception the Stryker was a controversial vehicle with prominent critics, both in Congress and elsewhere, calling



## Stryker Interim Combat Vehicle



**A M1130 CV of 1st Battalion, 23rd Infantry Regiment, 3rd Brigade, 2nd Infantry Division in Tal Afar, Iraq, in September 2004. Note the slat armour designed to counter RPGs and additional antennae of the Command Vehicle.** (NARA: Sgt. Jeremiah Johnson)



**A M1132 Engineer Squad Vehicle (ESV) of 4th Squadron, 2nd Cavalry Regiment leaves the Czech Republic en route for Poland during Exercise Dragoon Ride in May 2016.** (U.S. Army photo by Spc. Sandy Barrientos)



**A M1133 Medical Evacuation Vehicle (MEV) of 2nd Cavalry Regiment on the Baumholder Maneuver Training Area “H” during the U.S. Army Europe Expert Field Medical Badge Competition in March 2016.** (U.S. Army Photo by Visual Information Specialist Ruediger Hess)



**Troopers assigned to Reaper Troop, 4th Squadron, 2nd Cavalry Regiment, drive their M1134 Anti-Tank Guided Missile (ATGM) Vehicle to its firing position during the squadron’s live-fire exercise at the Grafenwoehr Training Area, in March 2016.** (U.S. Army photo by Sgt. William A. Tanner)



**A good rear view of M1132 ESVs of 2nd Cavalry Regiment as they prepare to move on the Bemowo Piskie Training Area, Poland in June 2017 during Exercise Saber Strike 17.** (U.S. Army photo by Samuel W. Brooks)



## Stryker Interim Combat Vehicle



**A Slovakian CBRN Soldier conducts decontamination procedures on a M1135 Nuclear, Biological, Chemical Reconnaissance Vehicle (NBC RV) during a simulated chemical training event as part of Exercise Toxic Lance at Training Center Lest, Slovakia in March 2017.** (U.S. Army photo by Sgt. Justin Geiger)



**A Mobile Expeditionary High Energy Laser (MEHEL) Stryker during a tactical road march, part of the Joint Warfighting Exercise at the Grafenwoehr Training Area in April 2018. The 5-kW MEHEL 2.1 vehicle is an experimental system designed to explore future laser weapons deployments for the U.S. Army.** (U.S. Army photo by Pfc. Maximilian Huth)



**A M1135 NBC RV from the 690th Chemical Company, U.S. Army Alabama National Guard, maneuvers around obstacles during the Joint Warfighting Assessment 19 in May 2019.** (U.S. Army photo by Pfc. Valentina Y. Montano)

into question its costs and effectiveness. The Stryker made its combat debut in November 2003 when 3rd Brigade, 2nd Infantry Division deployed to Iraq. The extensive training the brigade received at the National Training Centre in Fort Irwin, California, and the in-theatre upgrades (particularly in the form of slat armour to protect against RPGs) proved their worth and the Stryker soon proved itself an effective defence against IEDs, as well as an capable weapon against insurgent forces.

3rd Brigade's most notable action was Operation Black Typhoon, designed to free the town of Tal Afar from insurgents, in September 2004. One incident in particular demonstrated the capabilities of the Stryker. On 4 September Iraqi insurgents succeeded in downing a Kiowa Warrior helicopter with an RPG. The Strykers succeeded in fighting their way through to

the crash site and both recovered the damaged helicopter and rescued the injured pilots. Five other Americans and two Iraqis were injured and one Stryker damaged, while the insurgents were reckoned to have suffered over a hundred casualties during the action.

### Conclusion

Designed to fulfil a very particular operational need for the U.S. Army in the 1990s, the Stryker proved itself a versatile and effective weapon of war in Iraq and Afghanistan. As the U.S. Army transitions from counter-insurgency low-intensity combat to preparing to once again face a near-peer adversary in Europe, the Stryker Brigade Combat Team is set to remain an integral part of their warfighting ability for the foreseeable future.



# The King of Battle

**David Grummitt** examines the long-serving M109 Self-Propelled Howitzer.

An M109A1 moves into position during Exercise Carbine Fortress, part of REFORGER 1982.  
(U.S. Army photo by SFC McBride)



It has been a truism since at least the days of the Prussian king Frederick the Great that artillery is the 'King of Battle'. Countless commanders from Napoleon to MacArthur have credited the field artillery with both their victories and their survival. The importance of artillery is unquestioned still on the modern battlefield and no weapons system exemplifies that better than the US Army's 155mm M109 Self-Propelled Howitzer.

## Development and Early History

Self-propelled artillery had played an important role in the Allied victory in World War II and vehicles such as the 105mm M7 Priest and 155mm M12 and M40, all based on the Sherman chassis, had featured among the US forces that fought in north-western Europe during the last year of the War. The M40 served in the Korean War alongside the M37 and M41 (mounting the 105mm and 155mm howitzers respectively and based on the M24 Chaffee light tank chassis), but two

replacement vehicles, based on the chassis of the M41 light tank, were in development by 1950. These vehicles, the M52 (105mm) and M44 (155mm) entered service in 1952, but both proved unsatisfactory. Work was soon underway to develop a new generation of fully enclosed self-propelled howitzers that could meet the challenges of the envisaged nuclear battlefield of the Cold War. Moreover, the development of effective artillery-location radar during the 1950s made counter-battery fire a very real threat and necessitated a much enhanced level of crew protection than that offered by the open-topped M44 and M52.

In 1959 the first prototypes of the T195 110mm and T196 155mm HSP (Howitzer Self-Propelled) enter testing. Problems with the engine and drive train delayed production, but eventually, in June 1963, they were accepted into service as the M108 and M109. Production of the former was short-lived – only 355 were built in 1963 – as the Army required a larger





**An M109A1 passes through the town of Schlitz-Willofs during Exercise Autumn Forge, part of REFORGER 1983. Note the typically colourful MERDC camouflage.** (U.S. Army)



**An M109A2 of 1-41 Field Artillery at Range 6 at Fort Carson prior to its deployment to support the United Nations' intervention in Somalia, UNOSOM II, in 1993.** (U.S. Army photo by SPC Gary A. Bryant)



**An M109A2 of A Battery, 4-29 Field Artillery outside Camp Steel Castle, Bosnia, as part of Operation Joint Endeavour in April 1996.** (U.S. Army photo by SPC Glenn W. Suggs)



**An M109A2 raises a cloud of dust as it leaves its firing position on Range 141 at Fort Carson, CO, in June 1999.** (U.S. Army photo by Michael Knapik)

gun. The M109 mounted the 23 calibre 155mm M126 howitzer and carried 28 rounds with a maximum range of 14,600 metres. Between 1963 and 1969 2,111 M109s were built for the US Army and Marine Corps, with a further 1,675 units built for export.

The M109 had its baptism of fire in the Vietnam War. Initially no armoured or mechanised units were deployed in theatre and commanders relied either on heavy, long-range artillery (such as the 203mm M110) or lighter towed pieces. By 1966, however, the utility of the M109 (and M108) was clear. Deployed in forward firebases, defended with earth works and sandbags, the M109 proved itself well-suited to supporting the infantry. Its traversable turret and M2HB .50cal machine gun also made it capable of defending itself against infantry attacks. By 1969, however, the M109s were being withdrawn and two years later the last battery left Vietnam. The Vietnam War had confirmed the basic soundness of the M109 design, but it had also revealed shortcomings in the M126 howitzer and its ammunition when compared to state-of-the-art Soviet designs such as the M46 130mm gun.

## Production Variants

The next four decades would witness a constant programme of measures to update and improve the performance of the M109, its gun and ammunition, alongside, ultimately futile, attempts

to design and produce a successor vehicle. The need for greater range had long been apparent and in 1971 the M109A1 entered service. This was armed with the 39 calibre M185 gun which increased the maximum range to 18,100 metres. Other changes necessitated by the increase in firepower included a strengthening of the torsion bar suspension and a new travel lock fitted to the front of the vehicle.

The conversion of M109s to A1 standard continued until 1981, but in the meantime a 'Mid-Life Improvement' program was instituted resulting in the M109A2 being adopted as for production in 1975. A new cannon mount, counterbalanced travel lock, and an improved engine accompanied a new turret bustle stowage arrangement which increased capacity from 28 to 26 rounds. Those M109A1s rebuilt to A2 standard were known as M109A3. The M109A2 eventually entered service in 1980 and 823 new vehicles were built between 1976 and 1985.

Throughout the 1970s and 80s much time, money and effort was spent in developing new forms of artillery round for the M109 series. These included rocket-assisted rounds, various types of sub-munitions and mines, and 'special' rounds. This latter category included chemical weapons (which remained in the US arsenal until 1997) and the W48 nuclear warhead, a simple plutonium-based weapon which delivered a yield equivalent to 72 tons of TNT. Some 3,000 of these tactical



## The King of Battle



**An M109A6 fires during the 34th Infantry Division's 1-125 Field Artillery live fire exercise in northern Kuwait in February 2012** (U.S. Army/ Sgt. Bob Brown)



**A well-stowed M109A6 travels along an Iraqi highway towards the Euphrates River during Operation Iraqi Freedom.** (USMC photo by L.Cpl. Andrew P. Roufs)



**A gunnery sergeant assigned to Bravo Battery, 1-201 Field Artillery Regiment, West Virginia National Guard, scans the horizon from his M109A6 for opposing forces during a battery defence exercise as part of an Exportable Combat Training Capability exercise at Camp Grayling Joint Maneuver Training Center in July 2014.** (U.S. Army photo by Spc. Seth LaCount)



**Airmen from the 74th Fighter Squadron and the 23rd Maintenance Group speak with soldiers from Alpha Battery, 2-29 Field Artillery, 1st Armored Division, about the mission and capabilities of the M109A6 howitzer during Exercise Iron Strike in December 2014, at the Oro Grande Range Complex, Fort Bliss, Texas. Exercise Iron Strike integrated armoured and artillery units and A-10 aircraft for realistic joint fire and close air support execution.** (U.S. Air Force photo by Airman 1st Class Ryan Callaghan)

nuclear weapons were deployed before they were withdrawn from frontline service with the end of the Cold War.

The 1980s saw further refinements to the M109 design. The M109A4 introduced enhanced NBC (Nuclear, Biological and Chemical) protection, but its deployment was limited to reserve and National Guard units. More significantly the Army launched the 'Howitzer Improvement Plan' (HIP) to develop a new M109, alongside the abortive attempts to design and develop a completely new self-propelled howitzer.

### The Paladin

The HIP resulted in the definitive model of the M109, the M109A6 Paladin. Beginning in 1985 various new guns were trialled and tested with the M109, eventually resulting in the adoption of the 39 calibre M284 cannon in a new mount. The M284 has a maximum range of 22,000 metres with normal munitions and 30,000 metres with rocket-assisted projectiles. Those M109A2/A3s fitted with the new gun and mount were designated M109A5, but the Paladin proper had much more extensive modifications. The Paladin has a redesigned, larger turret incorporating new navigation systems, sensors and a

digital communications system. The improvement in rates of fire and accuracy are startling: the Paladin can deploy from the march and be ready to fire within thirty seconds. The Paladin is deployed today in field artillery regiments as part of the Armoured Brigade Combat Team (ABCT). An ABCT currently fields sixteen M109A6s in two batteries and they are deployed in Poland and Germany as part of US Army Europe, as well as on the Korean Peninsula.

The ultimate version of the M109, the M109A7, entered low-level production in 2014. The M109A7 is the result of the Paladin Integrated Management Program. The new variant sports an entirely new chassis and drive train, engine, suspension and steering system, utilising components from the Bradley Fighting Vehicle family. It also has an enhanced 600-volt on-board power system designed to service the emerging technologies of the digital battlefield. It is heavier and faster than the M109A6 but can sustain a one round per minute rate of fire with deadly accuracy. The first vehicles were delivered in April 2015 and full production of 48 vehicles in the initial batch started in 2018.



## The M109 in Action

The US Army's M109s have seen action in Vietnam, in the First Gulf War, in the former Yugoslavia, and, most recently, in Iraq. After its first taste of combat in Vietnam, the M109 has proved itself a highly effective weapons system. During the First Gulf War no fewer than 582 M109A2/A3s were deployed in 25 artillery battalions, firing some 43,000 rounds. These were mainly DPICM rounds, which unleashed a rain of submunitions and steel fragments on the hapless Iraqi forces, but also included 100 Copperhead laser-guided munitions used to destroy enemy tanks.

In Operation Iraqi Freedom and in subsequent operations in that country the M109A6 cemented its reputation. The deployment of M109s for the 2003 invasion of Iraq was less than half of that to the Gulf twelve years earlier and as the United States fought the 'War on Terror' the continued relevance of field artillery was called into question. Indeed, the proposed successor to the M109, the Crusader project, had been cancelled in May 2002 and the artillery was conspicuous by its absence from the operations in Afghanistan. During Operation Iraqi Freedom the Iraqi artillery both outranged and outnumbered the divisional artillery deployed with 101st Airborne and 3rd Infantry Division, yet time and time again it proved itself essential in destroying enemy artillery and



A loader from Battery B 1-41 Field Artillery Regiment, 1st Armored Brigade Combat Team, 3rd Infantry Division, loads a 155mm artillery round in an M109A6 during Exercise Anakonda 16 in the Drawsko Pomorskie Training Area (DPTA) near Oleszno, Poland. (U.S. Army photo by Sgt. Ashley Marble)



The unit's M109A6s during Flaming Thunder at Pabrade, Lithuania in August 2016. Flaming Thunder was a two-week long multinational fire coordination exercise and combined arms live fire to enhance interoperability among NATO fire support units, and to train and conduct joint fire support with the integration of maneuver elements, close air support and close combat attack. (U.S. Army photo by Sgt. James Duktavich)



M109A6 from Battery A of the same unit establish firing positions at Grafenwoehr Training Area, Germany as they prepare to shoot their Artillery Table XII qualification. The training certified platoons as they prepared for Exercise Flaming Thunder in Lithuania and Combined Resolve VII in Germany in the late summer of 2016. (U.S. Army photo by Maj. Randy Ready)



An M10916 of Company A, 4-1 Field Artillery Regiment after a fire mission at Al Asad Air Base, Iraq, in January 2017. Field artillery at Al Assad Air Base provided support for Iraqi security forces as part of Combined Joint Task Force – Operation Inherent Resolve, the Coalition to defeat ISIS in Iraq and Syria. (U.S. Army photo by Sgt. Lisa Soy)



M109A6s from 3-29 Field Artillery Regiment, 3rd ABCT, 4th Infantry Division, drive off of a flatcar on north-eastern Poland in January 2017. The howitzer was one of 53 vehicles that arrived in north-eastern Poland from the Port of Bremerhaven, Germany as part of Operation Atlantic Resolve. (U.S. Army photo by Sgt. Corinna Baltos)



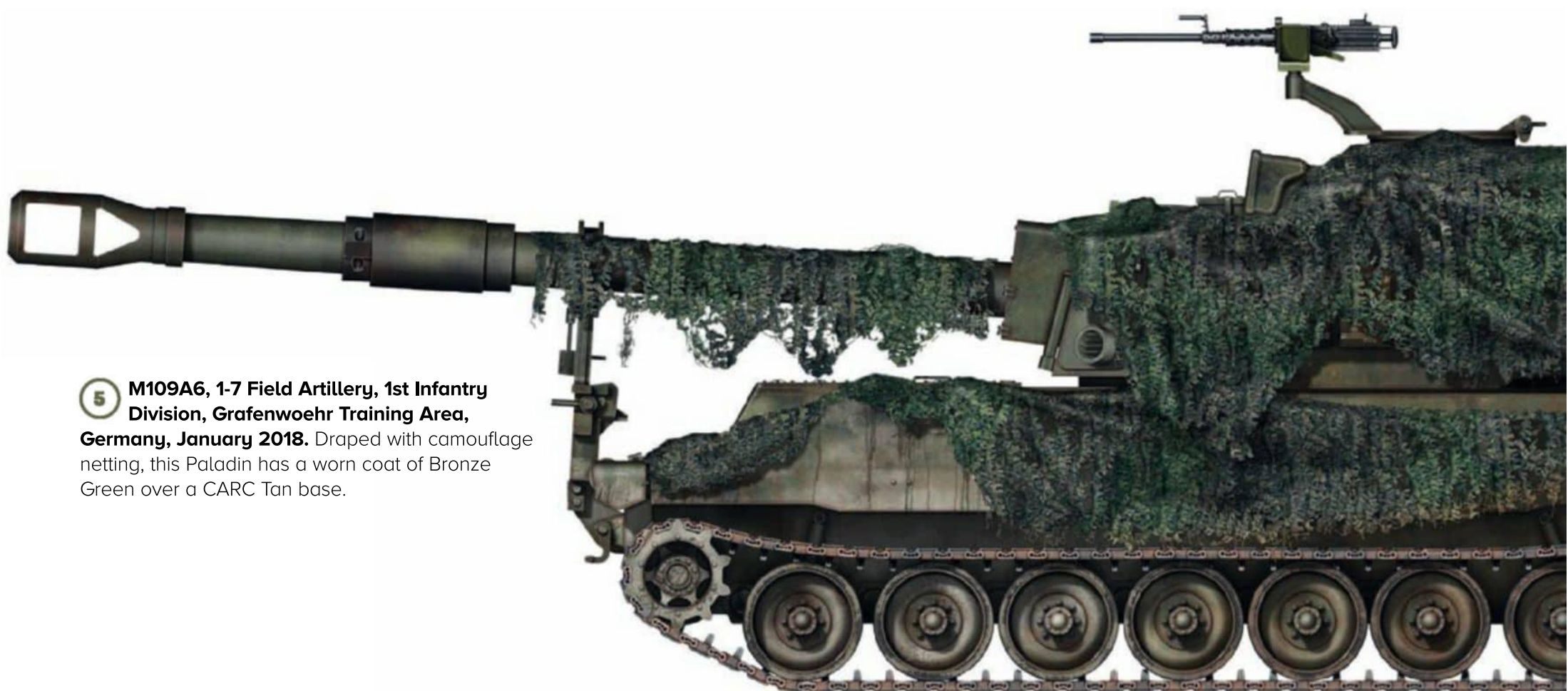
## The King of Battle



① **M109A2, A Battery, 4-29 Field Artillery, Camp Steel Castle, Bosnia, April 1996.** Finished in standard NATO three-colour camouflage. Note the prominent IFOR ('Implementation Force') marking in white on the hull side.



③ **M109A6, 3-29 Field Artillery, 4th Infantry Division, Grafenwoehr Training Area, Germany, September 2017.** M1A2s, Bradley Fighting Vehicles and Paladins of 3rd Armored Brigade Combat Team, 4th Infantry Division, were all similarly painted with a washeable Bronze Green paint over the CARC Tan base during their 2017 tour of duty as part of Operation Atlantic Resolve.



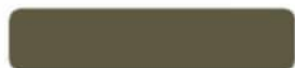
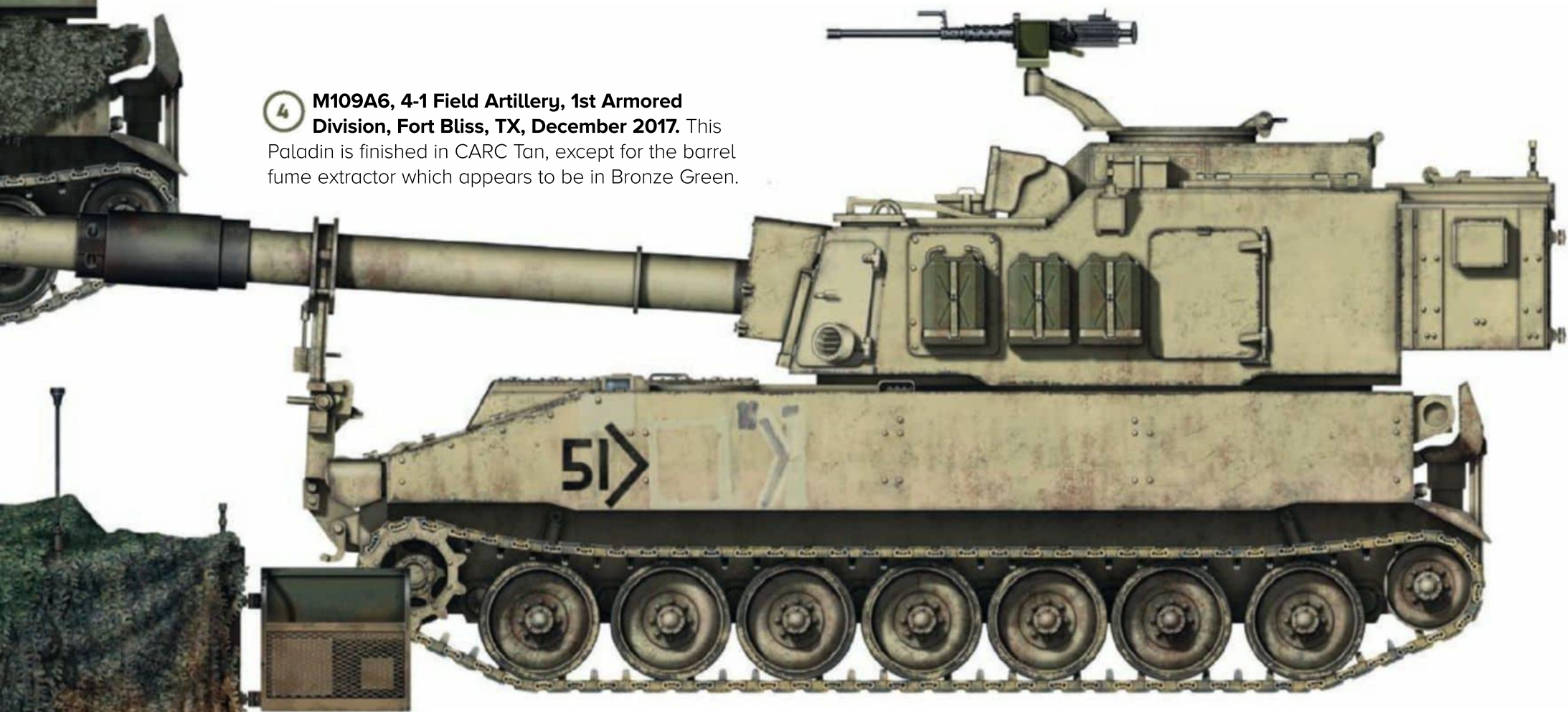
⑤ **M109A6, 1-7 Field Artillery, 1st Infantry Division, Grafenwoehr Training Area, Germany, January 2018.** Draped with camouflage netting, this Paladin has a worn coat of Bronze Green over a CARC Tan base.



**2** M109A6, Operation Anakonda, 1-41 Field Artillery, 3rd Infantry Division, Drawsko Pomorskie Training Ground, Poland, June 2016. This Paladin is finished in a standard three-colour NATO scheme with the battery markings added in green tape.



**4** M109A6, 4-1 Field Artillery, 1st Armored Division, Fort Bliss, TX, December 2017. This Paladin is finished in CARC Tan, except for the barrel fume extractor which appears to be in Bronze Green.



Bronze Green  
RAL6031  
(Vallejo 71.250  
Bronze Green)



NATO Brown  
(Vallejo 71.249  
NATO Brown)



CARC Tan 686  
(Vallejo 71.122  
US Desert Armour 686)



NATO Green  
(Vallejo 71.093 NATO Green)



Black  
(Vallejo 71.057 Black)

**All paint  
references are to  
Vallejo Model Air**

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## The King of Battle



**Soldiers of 3-29 Field Artillery Regiment prepare to fire an M109A6 during Exercise Combined Resolve VIII at the Grafenwoehr Training Area, Grafenwoehr, Germany in April 2017. Exercise Combined Resolve happens twice yearly and is the U.S. Army Europe Command's most important field training exercise, involving thousands of servicemen and women from the U.S. and other NATO and partner nations. (U.S. Army photo by Spc. Randy Wren)**

rocket systems. During sandstorms, the M109s and other guns provided artillery cover in the absence of air support. Essentially, during the invasion of Iraq the M109A6 excelled in the traditional role of artillery: providing effective and integrated close fire support to the infantry. The impact of the M109A6 was further enhanced by the presence of the M7 Bradley Fire Support Team Vehicle, which could keep up with the forward elements of the Combined Arms infantry and armour combat teams, providing precise coordinates within 50 metres at ranges up to 8,000 metres. The ability of the Paladin to keep up with the Bradleys and the Abrams, indeed the insistence of field commanders that they did so, and to provide both direct and indirect accurate fire support quickly was key to the remarkable success it enjoyed in the opening encounters of Operation Iraqi Freedom. The Paladin's success in suppressing the Iraqi artillery meant that



**An M992A2 Field Artillery Ammunition Supply Vehicle from 1-5 Field Artillery Regiment, 1st ABCT, 1st Infantry Division, resupplies an M109A6 Paladin artillery system with ammunition during a gunnery qualification training event in Yeoncheon-gun, South Korea in March 2017 (U.S. Army photo by Capt. Jonathan Camire)**



**3-29 Field Artillery Regiment then moved to conduct Table VI qualifications, firing the first 155 mm rounds in Poland at the training site in Drawsko Pomorskie. (U.S. Army photo by Staff Sgt. Elizabeth Tarr)**

during the invasion no American lives were lost to enemy artillery fire. A brigade commander from 3rd Infantry Division noted "the Iraqis had a lot of artillery, he used it extensively, but the combination of Paladin howitzers and the [Hughes AN/TP]Q36 [weapon locating] radar was deadly. If he didn't move, he was dead. The 1-10 Field Artillery fired about 1,000 rounds during the battles around An Nasiriyah. The Iraqis [as a result] very seldom massed fires." ('U.S. Army Field Artillery Relevance on the Modern Battlefield', Marine Corps University, 2004)

### Conclusion

Operation Iraqi Freedom and the subsequent actions by the US armed forces in that country confirmed the importance of the M109 to combined arms maneuver warfare. Alongside the M1 Abrams MBT and the Bradley Fighting Vehicle, the M109 is central to American war-fighting doctrine as the US Army reorients itself towards peer-to-peer or near-peer encounters. Put simply, the Paladin will be around for a few decades to come.





The crew of a Mississippi National Guard M109A6 from the 155th Armored Brigade Combat Team, observes a passing helicopter at the National Training Center in June 2017. (Mississippi National Guard photo by Sgt. Edward Lee)



Soldiers of 3-29 Field Artillery Regiment, 3rd ABCT, 4th Infantry Division, ground guide their M109A6s to the firing point during a direct fire exercise at the 7th Army Training Command's Grafenwoehr Training Area, Germany, in September 2017. (U.S. Army photo by Staff Sgt. Ange Desinor)



A M109A6 Paladin assigned to 4-1 Field Artillery Regiment at Fort Bliss, Texas in December 2017. This was part of an area occupation exercise with his section as part of 1st Armored Division Artillery's Best by Test competition. (U.S. Army photo by Sgt. Kris Bonet)



An M109A6 fires during a live fire exercise for 3-16 Field Artillery Regiment, 210th Field Artillery Brigade, 2nd Infantry Division/ROK-US Combined Division at a live fire training area in Yeoncheon-gun, South Korea, in September 2017. (U.S. Army photo by Pfc. Hyeonmin Lee)



Battery A, 1-7 Field Artillery Regiment, 2nd ABCT, 1st Infantry Division, prepare their M109A6s during a live fire exercise at the 7th Army Training Command's Grafenwoehr Training Area, in January 2018. (U.S. Army photo by Markus Rauchenberger)



M109A6s of the same unit in preparation for a live fire exercise at Grafenwoehr Training Area, in February 2018. Note the camouflage netting on the side of the vehicle, this is characteristic of the AFVs of 2nd ABCT. (U.S. Army photo by Markus Rauchenberger)



The King of Battle



Another 1-7 Field Artillery Regiment M109A6 at Grafenwoehr. Note the locally applied coat of washable Bronze Green paint applied over the standard CARC Tan finish. The Bronze Green paint quickly degrades when out on exercise. (U.S. Army photo by Staff Sgt. Sharon Matthias)



A useful overhead view of a pristine M109A6 of 11th Armored Cavalry Regiment during the annual Armed Forces Day Parade held in May each year in the Californian town of Torrance. (U.S. Army photo by Sgt. Justin May)



Paladins of 1-5 Field Artillery assembled in the Polish port of Gdynia prior to their return home to Fort Riley, Kansas, as the end of their rotation as part of Operation Atlantic Resolve. (U.S. Army photo by Staff Sgt. True Thao)



M109A7s of Bravo Battery, 1-5 Field Artillery during Exercise Combined Resolve XII at the Grafenwoehr Training Area in August 2019. (U.S. Army photo by Cpl. Shawn Pierce)

An M109A7 of Delta Battery, 1-5 Field Artillery, 1st Armored Brigade Combat Team, during Table-12 certification at Toruń, Poland prior to field exercises in March 2019. (U.S. Army photo by Sgt. Jeremiah Woods)





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# Modelling Gallery



## The King of the Battle

**David Grummitt,**  
**AFV Club, 1/35 scale**  
(Military Modelcraft  
International  
November 2018)

M109A6 Paladin, 1-82 Field  
Artillery, 1st ABCT, Zagan,  
Poland, September 2018





M1296 Stryker Dragoon,  
1-2 Cavalry, Buamholder  
Training Area, Germany,  
January 2019

**Stryker Dragoon ICV**

**David Chou, AFV Club, 1/35 scale**

(Military Modelcraft International  
November 2019)







## FV 510 Warrior

**Paul Brickles,**  
**Academy, 1/35 scale**  
 (Military Modelcraft  
 International  
 December 2019)

FV510 Warrior, 4<sup>th</sup> Battalion,  
 The Rifles, Exercise Lion  
 Strike, Salisbury Plain, 2013







## Queen of the Desert

**Łukasz Orczyk-Musiak, Tamiya, 1/35 scale**

(Military Modelcraft International November 2017)

Challenger 2, Royal Scots Dragoon Guards, Operation Telic, Iraq, May 2003





FV510 Warrior



The FV510 Warrior weighs just over 26 metric tonnes in combat order, and can achieve a road speed of 75 km/hour. We can see the large one-piece driver's hatch in the fully open position on this FV510 section vehicle, photographed in the late 1990s on Salisbury Plain. (Lawrence Skuse)



The FV510 possesses a high power to weight ratio, a reliable powertrain and has excellent cross-country mobility. This OPFOR FV510 Warrior of the Black Watch was photographed during Operation Mona, a firepower demonstration on Salisbury Plain. The driver seems to have avoided getting too filthy, the same cannot be said for his vehicle! (Lawrence Skuse)



The Warrior family can easily keep station with the Challenger 2 MBT, and has served with distinction in two major mechanized conflicts, in 1991 and again in 2003. This was the role originally envisioned for the FV510, although the basic design has proved adaptable to every mission it has faced. (Lawrence Skuse)



An FV510 Warrior of 5th Battalion, the Rifles, during Exercise Bavarian Charger in May 2013. (Ministry of Defence, Cpl Wes Calder RLC)



# FV510 Warrior

**M.P. Robinson** looks at Britain's Infantry Combat Vehicle.

One shock among many to affect Western military thinking in the late 1960s and especially in the aftermath of the 1973 Arab-Israeli War was the discovery of the Soviet BMP mechanized infantry combat vehicle. The Soviets had succeeded in creating a light, amphibious armoured personnel carrier vehicle armed with a turreted main armament and guided missiles that far outclassed armoured vehicles like the M113 and FV432 in terms of fighting power. In West Germany the Bundeswehr had already developed the Schützenpanzer Marder, a much heavier vehicle than the BMP which was the first NATO vehicle to emerge in this class in 1969. In France the lighter AMX10P was developed and entered service in 1975. In the United States work to develop an MICV resulted in the program that

yielded the excellent M2 and M3 Bradley Mechanized Infantry Combat Vehicle.

Britain took a slightly different view of the problem from the Americans and West Germans, retaining the doctrine of the Armoured Personnel Carrier it already had for the FV432 and extending it, and adopting a far simpler solution than the Marder or the Bradley. The MCV80 program was the result, an amphibious mechanized infantry vehicle in the 25-ton range. It featured an aluminium armoured hull fitted with a two-man steel armoured turreted mounting a 30mm RARDEN cannon in an unstabilized mounting. It was not armed with Antitank Guided Missiles as standard weapons and was not fitted with firing ports for its embarked infantry. It could carry seven men



FV510 Warrior



The Warrior hull is only immune to heavy machinegun fire up to 14.5mm and shell splinters, but can be fitted with Chobham applique arrays to give a much higher level of immunity. One Warrior was reportedly accidentally hit by a 120mm HESH round fired by a Challenger 1 during Operation Granby, but its Chobham armour absorbed the blast and the vehicle remained operational. (Lawrence Skuse)



Over 1000 Warrior series vehicles were originally envisioned for the British Army’s Mechanized Infantry regiments, but after Operation Granby the order was cut to 789 vehicles of all types, which required the retention of the FV432 in service for decades longer than expected. (Lawrence Skuse)



Despite an excellent performance in trials in Norway, Finland and Saudi Arabia, only Kuwait has thus far purchased the Warrior. The basic chassis, especially if manufactured in steel RHA armour plate, would have formed the basis for an excellent medium weight tank. Sadly much of the Warrior’s developmental potential could not be explored because of defence cuts and because of the mass of cheap and available weaponry that flooded the arms markets after the end of the Cold War. (Lawrence Skuse)



FV510 Warriors of the Black Watch engage Chieftain hard targets during Operation Mona. The Warrior’s 30mm RARDEN cannon is not stabilized and has to be fired at the halt to be certain of a first round hit. (Lawrence Skuse)



The FV510 Warrior is equipped with Pilkington PE RAVEN sights for the commander and gunner. Its 30mm RARDEN cannon can penetrate over 40mm of RHA armour at normal combat ranges, firing in three round bursts or in single shots. This Warrior was photographed on the range during Exercise Saber Junction 2012. (U.S. Army)



An embarked infantry group typically carried a 7.62mm GPMG, two 5.56mm LSWs, and four SA80 Assault Rifles, as well as up to four antitank rockets. The FV510 section vehicle could sustain its crew and embarked infantry for up to 48 hours closed down, and even included a chemical toilet in its basic equipment. (Lawrence Skuse)





**A Stabilization Force (SFOR) Warrior armored fighting vehicles move into position during a live-fire exercise in Bosnia during Operation Joint Guardian in June 1997.** (National Archives)



**An FV513 Mechanized Recovery Vehicle (Repair) (MRV(R)) during Operation Desert Shield in Kuwait in the run-up to the 2003 invasion of Iraq.** (National Archives)



**A British soldier from the 1st Battalion, the Staffordshire Regiment, directs a Warrior into position during Operation Desert Shield.** (National Archives)

in addition to its eight-man crew, and it was mobile enough to operate with Challenger MBTs, which the FV432 was too slow to manage. It was designed from the outset as a vehicle which could be fitted with Chobham Armour applique kits to provide a high level of immunity from RPG and ATGMs and it was fitted with an effective NBC system to enable operation on a nuclear contaminated battlefield.

The MCV80 program ran through its project definition stage from 1977 to 1979 alongside the MBT80 MBT program and some General Staff officers were charged with responsibilities in both programs, which permitted some important insights into compatibility. When the Royal Ordnance Shir 2 was adopted as the Challenger MBT and the MBT80 was cancelled, mobility capabilities required little revision because the MCV80 was in fact faster than the new battle tank. The MCV80 program was tendered by GKN Defence (who had built the FV432) and Vickers Defence. The government set very strict reliability provisions in the design, which had to be

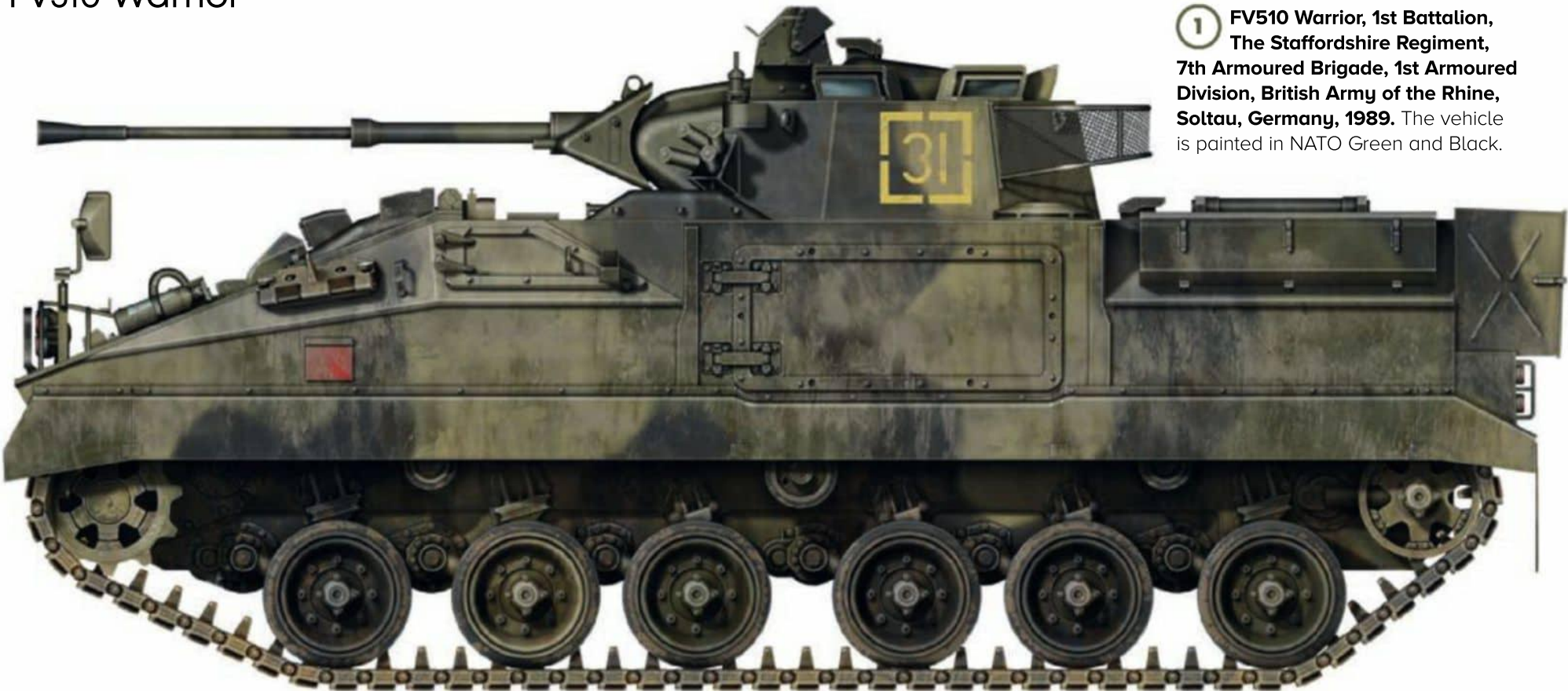
met and were identified in the contract, which was won by GKN as prime contractor in 1979. Production of the complete powerpack was subcontracted to Rolls-Royce (later Perkins) and production of the complete steel turret was subcontracted to Vickers. GKN manufactured the hulls and integrated the turrets and powerpacks on their production line. Optics were supplied by Pilkington and the 30mm RARDEN cannon main armament was supplied to Vickers by Royal Ordnance. The production arrangement was very successful and very good reliability was achieved in the whole weapon system. A similar requirement was not imposed on Royal Ordnance for the Challenger MBT but would be in the 1990s when Vickers developed the Challenger 2.

Compared to the US M2 and M3, the FV510 Warrior (as the MCV80 was eventually designated) is a simpler vehicle, especially in its turret systems. This was done to keep costs within budget while still providing an effective weapon system against light armoured targets and to a lesser extent against



FV510 Warrior

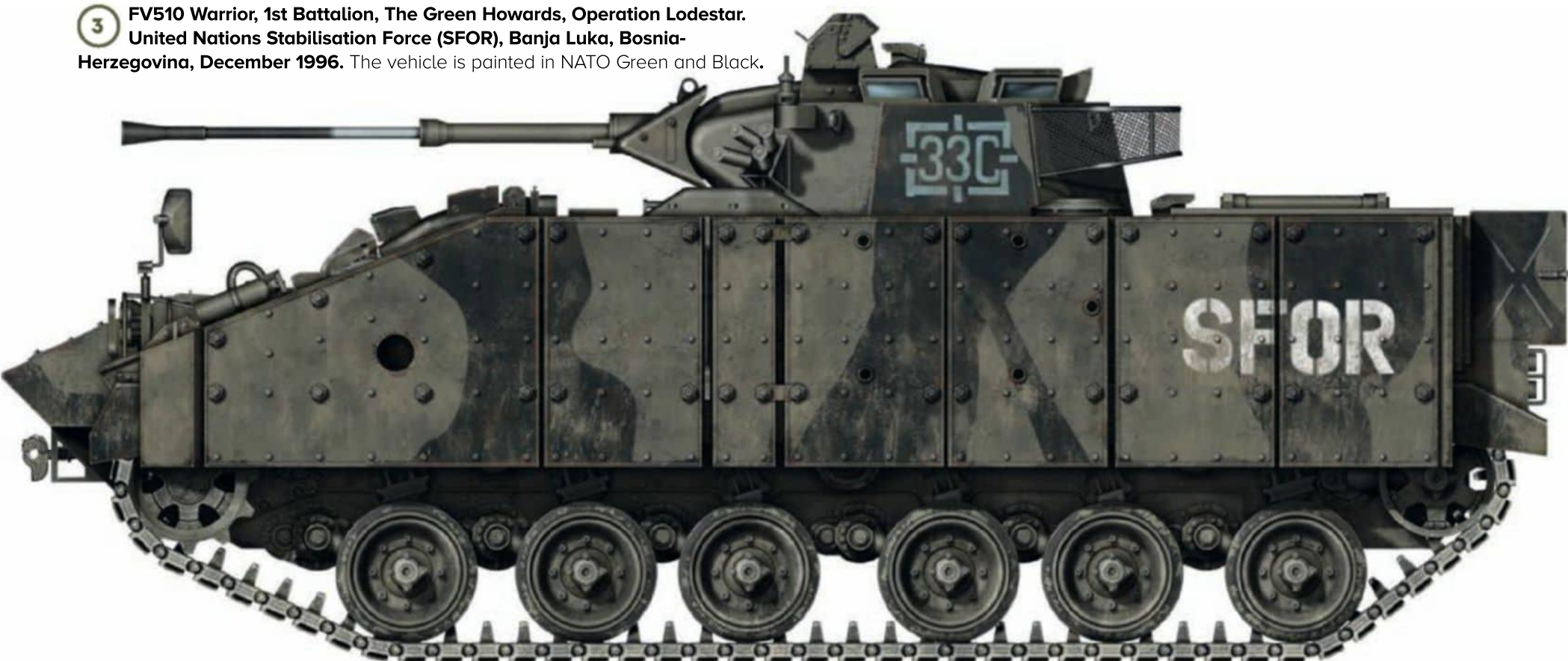
① FV510 Warrior, 1st Battalion, The Staffordshire Regiment, 7th Armoured Brigade, 1st Armoured Division, British Army of the Rhine, Soltau, Germany, 1989. The vehicle is painted in NATO Green and Black.



② FV510 Warrior, 1st Battalion, The Cheshire Regiment, Operation Grapple I, Tomislavograd, Bosnia, 1993. Operating under the United Nations mandate, the vehicle is painted white with UN markings.

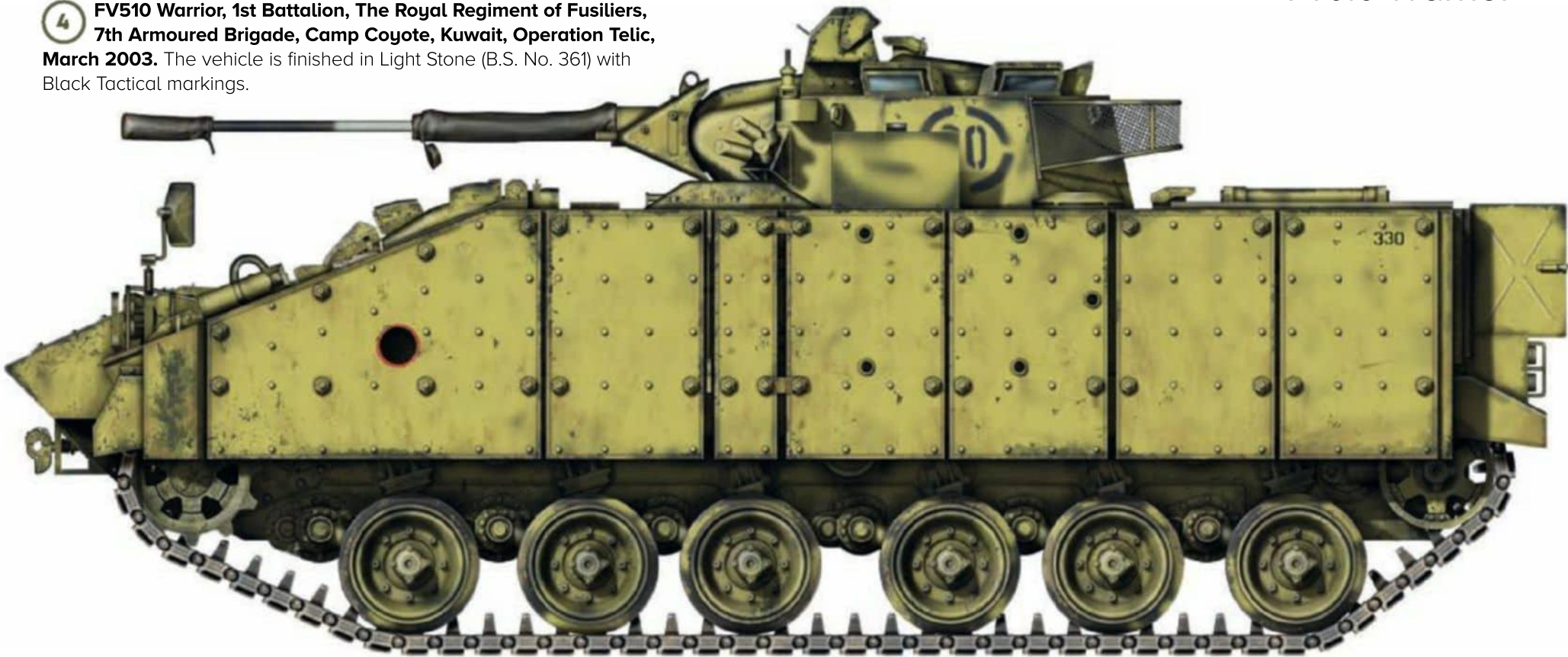


③ FV510 Warrior, 1st Battalion, The Green Howards, Operation Lodestar. United Nations Stabilisation Force (SFOR), Banja Luka, Bosnia-Herzegovina, December 1996. The vehicle is painted in NATO Green and Black.

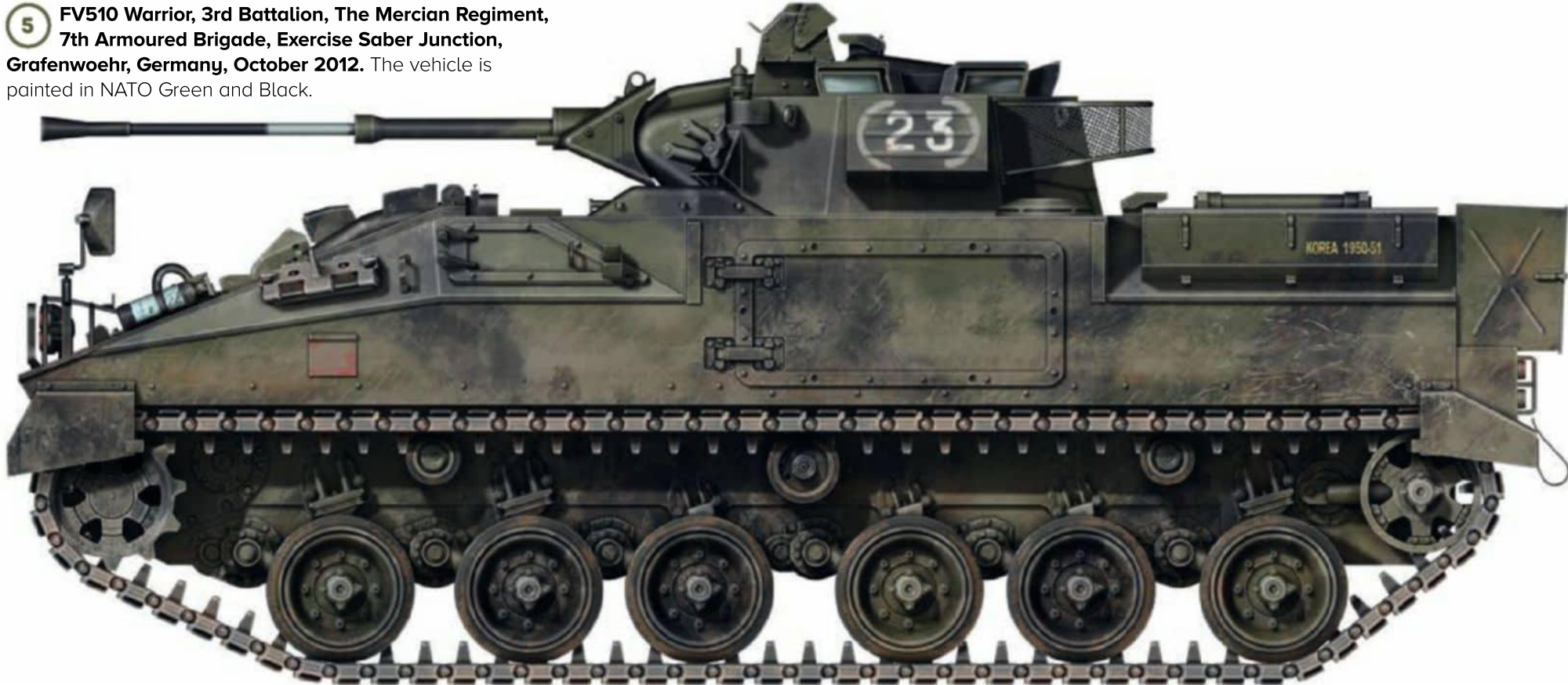




4 FV510 Warrior, 1st Battalion, The Royal Regiment of Fusiliers, 7th Armoured Brigade, Camp Coyote, Kuwait, Operation Telic, March 2003. The vehicle is finished in Light Stone (B.S. No. 361) with Black Tactical markings.



5 FV510 Warrior, 3rd Battalion, The Mercian Regiment, 7th Armoured Brigade, Exercise Saber Junction, Grafenwoehr, Germany, October 2012. The vehicle is painted in NATO Green and Black.



(USMC Army photo by Sgt. Paul Anstine)



(National Archives)



(Unknown)

NATO Green  
(Vallejo 71.093 NATO Green)

NATO Black  
(Vallejo 71.251 NATO Black)

White  
(Vallejo 71.001 White)

Light Stone  
(Vallejo 71.143 UK Light Stone)

All paint references are to Vallejo Model Air  
For more details on Vallejo's range of colours, please visit their website [www.acrylicosvallejo.com](http://www.acrylicosvallejo.com)





FV510 Warrior



A Warrior of 2nd Battalion, the Royal Welsh, pushes forward from Forward Operating Base Price during Operation Panther's Claw in Helmand Province, Afghanistan in June 2009. (Ministry of Defence)



One of the last Warriors in Iraq, belonging to 1st Battalion, the Princess of Wales's Royal Regiment, evacuated from Basra in the summer of 2009 as part of Operation Brockdale. (Ministry of Defence)



An FV510 Warrior Section Vehicle serving with the Royal Regiment of Scotland in 2012 in Helmand Province, Afghanistan. Bar armour was employed to give additional protection from RPG type weapons. (Ministry of Defence, Open License)



A Warrior of 1st Battalion, the Princess of Wales's Royal Regiment near Shaibah Logistic Base, Iraq, during Operation Telic VIII in 2006. (Ministry of Defence, Open License)



A Warrior from 4th Battalion, the Rifles, photographed during Exercise Lion Strike on Salisbury Plain in 2013 (Ministry of Defence, Cpl Si Longworth RLC)





**An armoured battlegroup worth of FV510 Warriors are maintained at BATUS. These, crewed by men of 5th Battalion, the Rifles, were photographed during Exercise Prairie Lightning in 2016. (Ministry of Defence, Cpl Mark Webster RLC)**



**A good overhead view of an FV510 Warrior from 1st Battalion, the Yorkshire Regiment during Exercise Dragon in Poland in 2015. (Ministry of Defence, Cpl Max Bryan)**



**A Warrior commander from 5th Battalion, the Rifles, surveys the Munster Lager training area in Germany during Exercise Saxon Charger in 2013. This exercise saw British troops operate as part of a composite platoon alongside German troops from Panzergrenadierbattalion 401. (Ministry of Defence, SSgt. Mark Nesbit RLC)**



**A Warrior from 1st Battalion, the Royal Regiment of Fusiliers during Exercise Prairie Storm at the British Army Training Unit Suffield (BATUS) in 2015. (Ministry of Defence, Cpl James McAllister RLC)**



## FV510 Warrior



Men from the 1st Battalion, the Princess of Wales's Royal Regiment, alongside Estonian troops, attack a stronghold at the Sennelager Ranges in Germany as part of Exercise Venerable Gauntlet for the NATO Very High Readiness Joint Task Force (VJTF) in 2016. (Ministry of Defence, Dominic King)



Armour upgrades to the FV510 are being regularly updated to provide the optimum level of protection to British soldiers wherever they might serve. Future plans include a new 40mm gunned stabilized turret for at least 240 FV510s. (Ministry of Defence, Open License)



1st Battalion, the Princess of Wales's Royal Regiment Warriors being re-fueled from an Oshkosh Wheeled Tanker during Exercise Allied Spirit VIII. This was a major NATO exercise held at the Grafenwöhr and Hohenfels Training Areas in southern Germany and involved some 4,000 soldiers from ten nations. (Ministry of Defence, Dominic King)

helicopters. Due to budgetary issues it entered service later than expected and in numbers that could not fully replace the FV432, which remains in service alongside the Warrior to this day. The FV510 underwent troop trials in 1984-1985 and full issue to mechanized infantry regiments in BAOR began in 1988, just as the Cold War was drawing to a close. The Warrior family included the following variants to serve in mechanized infantry regiments and in the Royal Artillery:

- FV510 Infantry Section Vehicle (489 produced, including 105 for MILAN ATGM teams)
- FV511 Command Vehicle (84 produced)
- FV512 Mechanized Combat Repair Vehicle with 6.5 ton crane (105 produced)
- FV513 Mechanized Recovery Vehicle (Repair) with 6.5 ton crane and 20 ton winch (39 produced)
- FV514 Mechanized Artillery Observation Vehicle with MSTAR Radar and PADS battlefield location system, fitted with a dummy 30mm gun. (52 produced)

- FV515 Battery Command Vehicle (19 produced for the Royal Artillery)

The Warrior family has received communication upgrades (Bowman system), thermal sights upgrades and several armour kit options have been developed to optimize protection on operations dependent on threat. The Warrior family have seen extensive service in the many postwar deployments undertaken by the British Army in Operation Granby, peacekeeping operations in the Balkans, and in Iraq and Afghanistan in the past two decades. Kuwait ordered 254 Warriors armed with a DELCO 25 mm stabilized gun turret in 1993. Warriors are expected to serve in the British Army until 2040 and FV510s will be upgraded with new 40mm stabilized gun turrets in the next few years. Most of the attached selection of Warrior photos are largely from private images that date from the late 1990s. These show the Warrior in use in training exercises, and the author would like to thank Lawrence Skuse for kindly sharing them.



# M2/M3 Bradley

**David Grummitt** examines the United States Army's versatile Bradley Fighting Vehicle.

Bradley Fighting Vehicles of 1-4 Cavalry, 1st ABCT, return from a live fire exercise at the Grafenwoehr Training Area as part of Exercise Combined Resolve XII in August 2019. (U.S. Army photo by Sgt. Thomas Mort)





## M2/M3 Bradley



**An M2 IFV on the range at Fort Benning, GA, in 1983. Note the MERDC camouflage scheme employed before the adoption of the standard NATO camouflage.** (U.S. Army photo by Spc. Bobby Mathis)



**An M2A2 IFV, Task Force 1-26, 2nd Brigade Combat Team, 1st Infantry Divisions during Exercise Noble Shepherd in preparation for their deployment to Tikrit, Iraq, from Germany in March 2006.** (U.S. Army photo by Spc. Billy Brothers)



**An M2A3 IFV of 1-64 Armor, 2nd Armored Brigade Combat Team (ABCT) at Range Red Cloud, Fort Stewart, GA.** (U.S. Army photo by Sgt. Richard Wrigley)



**A nice study of a heavily weathered Bradley from 1st ABCT at Camp Ujmajor, Hungary, during Exercise Warpaint Ride in August 2016, a Combined Arms Live Fire Exercise with Hungarian soldiers.** (U.S. Army photo by Spc. Ryan Tatum)

The Bradley Fighting Vehicle has been an integral part of the United States Army's armoured tactics since the early 1980s. It was developed in response to the Soviet BMP Infantry Fighting Vehicle (IFV). The IFV concept was markedly different to the 'battle taxis' or armoured personnel carriers (APCs) of the earlier Cold War (the Soviet BTR series, the American M113 and the British FV432). These were simply designed to provide transport for infantry to the frontline in a protected vehicle designed to follow the armoured spearhead. The IFV concept called for fully armoured and tracked vehicles that could both keep pace with the main battle tanks and carry sufficient lethal firepower to engage lightly armoured vehicles (with its main gun) and MBTs (with Anti-Tank Guided Missiles (ATGMs)). The Bradley was designed to keep pace with the M1 Abrams MBT and for almost four decades the two vehicles have provided the teeth of the armoured formations of the U.S. Army as part of the fast-paced manoeuvre warfare first envisaged as the way to engage and defeat the Warsaw Pact in the mid-1980s.

### Development

The need for an IFV to survive the high-intensity, Nuclear, Biological and Chemical (NBC) environment of any major conflict with the Soviet Union was recognised by American developers as early as the late 1950s. Alongside the

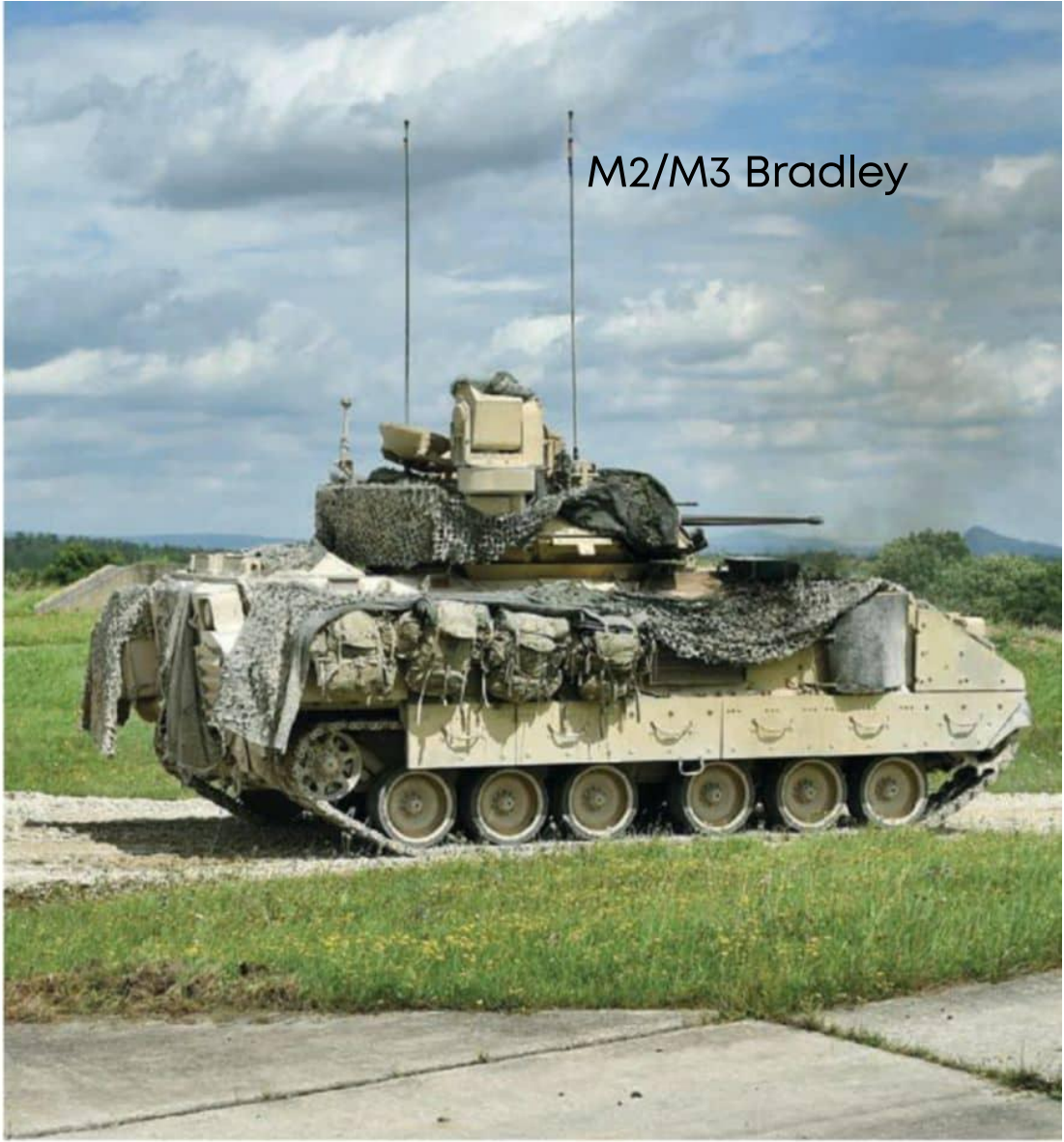
development of the MBT-70 between the Americans and Germans, there was also a programme to develop a Mechanized Infantry Combat Vehicle (MICV-70). Whereas the former led, in a convoluted way, to the Leopard 2 and M1 Abrams, the MICV project was abandoned in 1968 as the vehicle could not be airlifted. The first public display of the BMP-1 a year earlier had, however, underscored the need for a replacement for the M113. An IFV based on the M113 was rejected as being too slow, while the newly developed German Marder IFV was judged to be too heavy and expensive.

In 1972 the Ford Motor Company won a contract to develop a prototype IFV, the XM723. The vehicle had aluminium armour proof against projectiles up to 14.5mm in calibre and could carry a fully-equipped infantry squad. It was originally armed with a turret-mounted 20mm cannon, but this was soon replaced with a two-man turret armed with a 25mm Bushmaster cannon and TOW missiles providing the all-important anti-armour capability. In 1977 it was re-named the XM2, with the cavalry reconnaissance version (which lacked the hull firing ports for the infantry squad and carried additional TOW missiles) named the XM3. The development of the XM2/3 was not straightforward and faced political as well as military questioning over cost, size and its ability to survive on the NBC battlefield. In 1978 plans to develop the M113 as an IFV were





**A Bradley Engineer Squad Vehicle (BESV) of 10th Brigade Engineer Battalion, 1st ABCT, during Exercise Combined Resolve VII at the Joint Multinational Readiness Center at Hohenfels, Germany, in September 2016. (U.S. Army photo by Pvt. Randy Wren)**



**M2A3s of the same unit conducts a live fire exercise on the Grafenwoehr Ranges in August 2017. Note the typically large amount of crew kit stowed on the vehicle's exterior and the use of camouflage netting. (U.S. Army photo by Gertrud Zach)**



**An M2A3 of 1-68 Armor, 3rd ABCT, training alongside Estonian troops at the Estonian Central Training Area in Tapa as part of Exercise Atlantic Resolve in April 2017. (U.S. Army photo by Jason Johnston)**



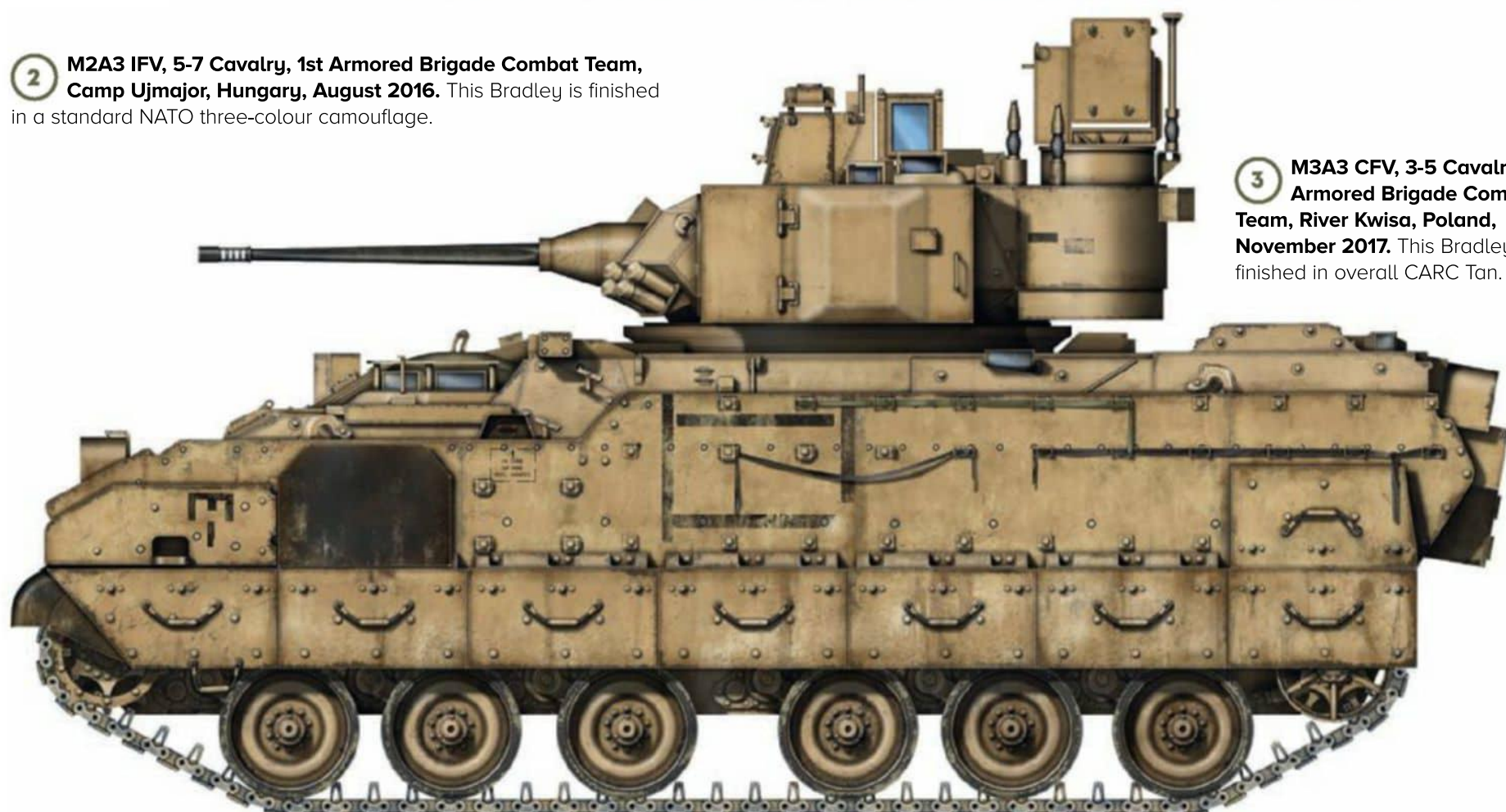
## M2/M3 Bradley



① **M2A3 IFV, 3-69 Armor, 3rd Armored Brigade Combat Team, Drowsko Pomorskie, Poland, April 2016.** Another NATO camouflaged Bradley. Folding the side skirts up gives the Bradley a very different appearance.

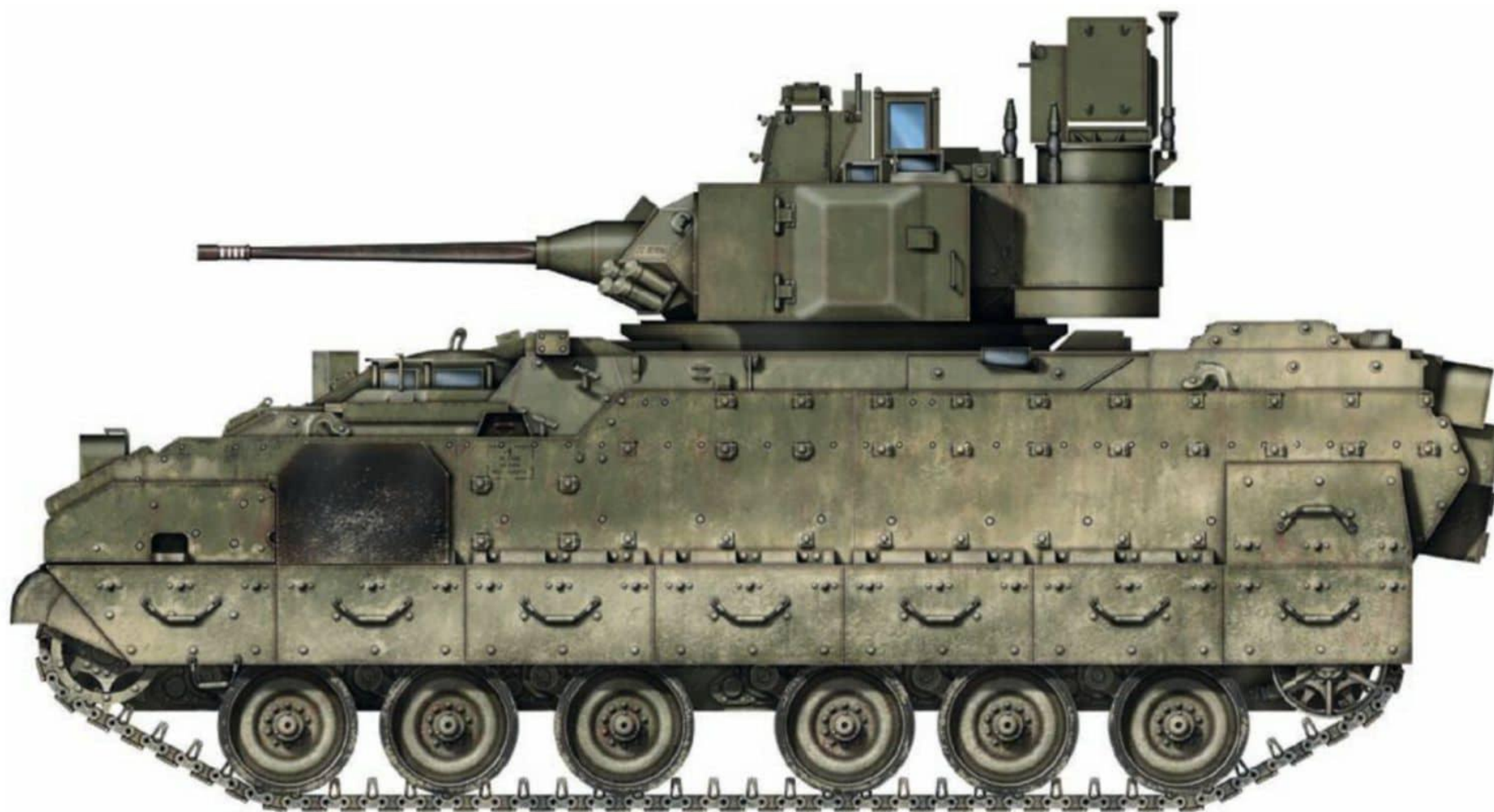


② **M2A3 IFV, 5-7 Cavalry, 1st Armored Brigade Combat Team, Camp Ujmajor, Hungary, August 2016.** This Bradley is finished in a standard NATO three-colour camouflage.

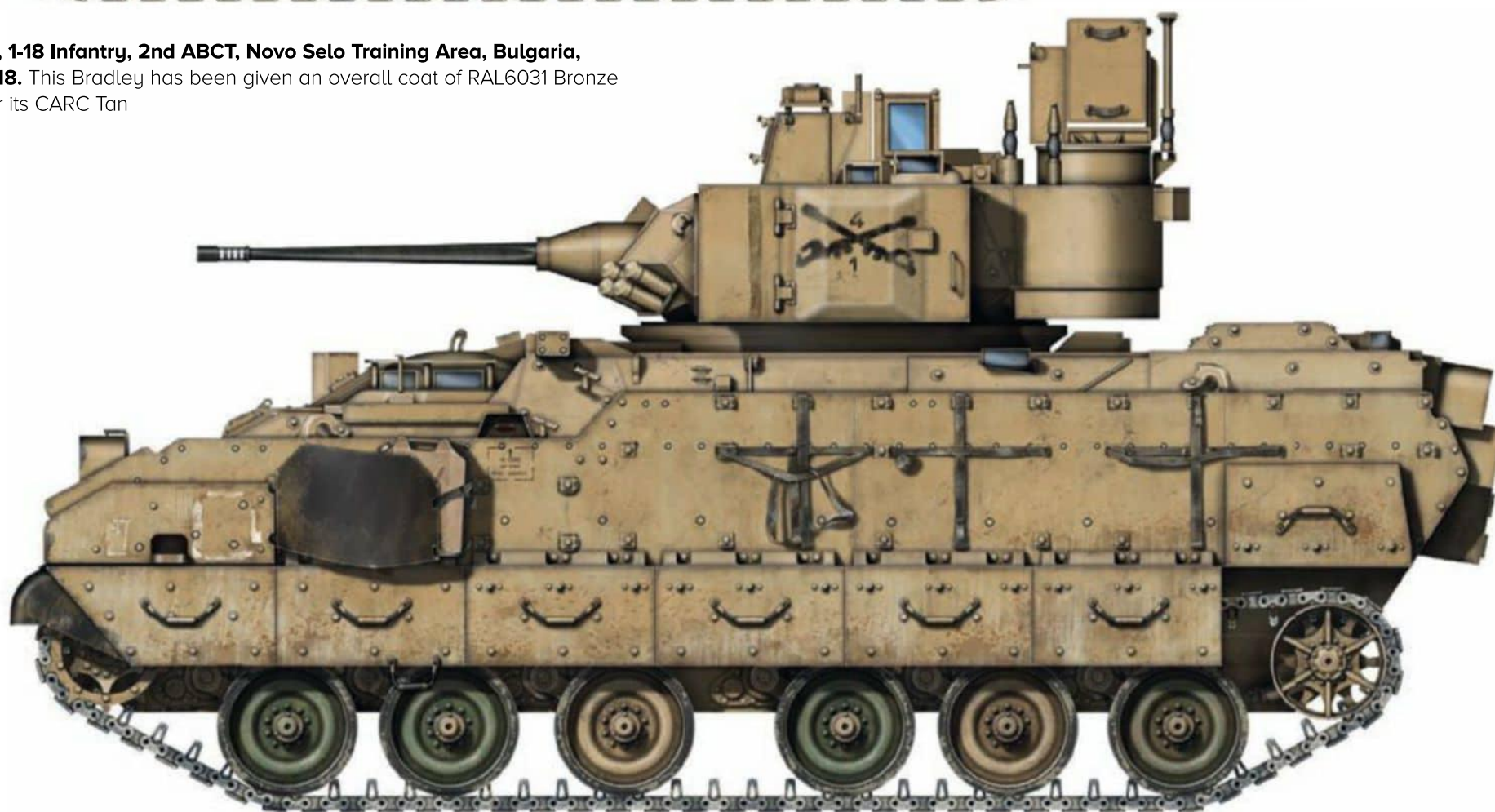


③ **M3A3 CFV, 3-5 Cavalry, 1st Armored Brigade Combat Team, River Kwisa, Poland, November 2017.** This Bradley is finished in overall CARC Tan.





**4** M2A3 IFV, 1-18 Infantry, 2nd ABCT, Novo Selo Training Area, Bulgaria, March 2018. This Bradley has been given an overall coat of RAL6031 Bronze Green paint over its CARC Tan



**5** M3A3 CFV, 1-4 Cavalry, 1st ABCT, Grafenwoehr Training Area, Germany, in August 2019. When 1st ABCT rotated back to Europe in the summer of 2019 its vehicles were all painted in overall CARC Tan.

**Bronze Green**  
RAL6031  
(Vallejo 71.250 Bronze Green)

**NATO Green**  
(Vallejo 71.093 NATO Green)

**NATO Brown**  
(Vallejo 71.249 NATO Brown)

**Black**  
(Vallejo 71.057 Black)

**CARC Tan 686**  
(Vallejo 71.122 US Desert Armour 686)

**All paint references are to Vallejo Model Air**

For more details on Vallejo's range of colours, please visit their website [www.acrylicosvallejo.com](http://www.acrylicosvallejo.com)





## M2/M3 Bradley



**M3A3 CFVs of 3-5 Cavalry wait their turn to cross the River Kwisa in Poland as part of multinational NATO exercises in November 2017.**  
(U.S. Army photo by Spc. Dustin Biven)

finally dropped and in the following year the XM2/3 passed the Army Systems Requisition Review Council. On 1 February 1980 procurement for service production was approved by the Secretary of Defense and in October 1981 the vehicle was formally adopted and named as the M2/M3 Bradley Fighting Vehicle, after General Omar Bradley, the hero of the Normandy campaign, who had died earlier that year.

### The Bradley Fighting Vehicle

In its essentials the Bradley Fighting Vehicle has not changed since its first deployment to 1-41st (Mechanized) Infantry, 2nd Armored Division in Germany in March 1983. The M2 Bradley IFV carried a crew of three and a six-man infantry squad. It was armed with the 25mm M242 Bushmaster cannon and a M240C 7.62mm coaxially. Initially the M2 Bradley had six firing ports along the hull side and rear for the infantry squad to fire their personal weapons, but in the M2A2 and M2A3 variants

all but the rearmost two ports have been plated over. The M2 was also fitted with a TOW (Tube-launched, Optically-tracked, Wire-guided) missile system (first introduced in the U.S. Army in 1970). The M2 carries seven additional rounds for the TOW missile system.

The M3 Cavalry Fighting Vehicle (CFV) is very similar to the M2 and, from most angles, indistinguishable from the outside. It too was armed with the 25mm Bushmaster, M240C and TOW missile system. It, however, was designed to operate in the traditional cavalry role of reconnaissance. Original M3s had plated-over pistol ports, while these have been deleted altogether from the M3A2 and M3A3 variants. Instead of holding six infantrymen, the M3's interior was designed to seat two scouts, additional communication equipment and twelve extra rounds for the TOW missile system.

Various production changes have been introduced during the Bradley's long service history. From 1986 the A1 variant



**An interesting photo of M2A3s of 2nd ABCT lining up to have their Multiple Integrated Laser Engagement System (MILES) gear fitted during Exercise Combined Resolve X in April 2018. The extensive wear to the RAL6031 Bronze Green paint is very evident.** (U.S. Army photo by Spc. Dustin Biven)



**Another image of heavily weathered Bradleys of 1-63 Armor, 2nd ABCT at Hohenfels during Exercise Combined Resolve X in May 2018.** (U.S. Army photo by Spc. Andrew McNeil)





M2/M3 Bradley

The Armored Brigade Combat Team to rotate to Europe as part of Operation Atlantic Resolve was 1st ABCT. Here M1A2 SEP Vs and Bradley Fighting Vehicles of 2-5 Cavalry zero their armaments at Zagan, Poland, in June 2018. (U.S. Army photo by Eugen Warkentin)



An M2A3 of 1-18 Infantry, 2nd ABCT, crosses the Novo Selo Training Area, Bulgaria, in March 2018. Note this Bradley has been given an overall coat of RAL6031 Bronze Green paint over its CARC Tan. (U.S. Army photo by Staff Sgt. Matthew Keeler)

introduced the TOW II missile system, a new NBC filtration and fire-suppressions systems. An additional infantryman was also included in the vehicle's crew. The A2 variant, introduced in 1988, was uparmoured with the ability to mount Explosive Reactive Armour (ERA) panels and the number of infantrymen in the M2A2 was again reduced to six. This was the version of the Bradley which was deployed to Saudi Arabia for Operation Desert Storm. Here the Bradley demonstrated its combat abilities for the first time, destroying more Iraqi armour than the combined M1 Abrams of the U.S. Army and Marine Corps. As

as result of the experience of war in the Gulf a further range of improvements were introduced in the early 1990s. These included a new laser rangefinder, GPS navigation equipment and the same digital command systems introduced into the M1A2 Abrams. A seventh infantryman was again accommodated in the rear of the crew compartment of the M2. These versions were known as M2A2/M3A2 ODS.

Currently the U.S. Army fields the M2A3 and M3A3 Bradley Fighting Vehicles. The changes introduced in 2000 were mainly digital, allowing the Bradley to integrate fully with the M1 Abrams and other vehicles of the armoured brigade combat team. These include the Improved Bradley Acquisition Subsystem (IBAS) and the Commander's Independent Viewer (CIV). The latter is the principal external change on the A3 version, mounted at the rear of the turret.

## Future of the Bradley

Alongside the M1 Abrams, the Bradley is the chief weapons system of the Armored Brigade Combat Team (ABCT). An ABCT fields 90 Bradleys: two companies of M2A3s in a Mechanized Infantry Battalion, one in an Armored Battalion and three troops of M3A3 in the Cavalry Reconnaissance Squadron, while Bradley Engineer Squad Vehicles are fielded in the Brigade Engineer Battalion.

The Bradley is currently being upgraded through a series of Engineering Change Proposals. These are designed to reduce the weight and improve the mobility of the vehicle



## M2/M3 Bradley



A nice study of an M3A3 of 1-4 Cavalry preparing for a live fire exercise at Świętoszów, Poland, shortly after arrival in Europe in February 2019. (U.S. Army photo by Sgt. Jeremiah Woods)



Another fine study of an M2A3 of the same unit during Exercise Strike Back 19 on the Novo Selo Training Area, Bulgaria, in June 2019. Here the Bradleys and Abrams of 1st ABCT trained alongside Albanian, Bulgarian, Greek and North Macedonian allies. (U.S. Army photo by Capt. Erica Mitchell)



Bradleys are also operated by various National Guard units in the United States. Here an M3A3 of 1-163 Cavalry, Montana Army National Guard, takes up position at the National Training Center in Fort Irwin, CA, in June 2019. (U.S. Army photo by Cpl. Alisha Grezlik)



Heavily bedecked with camouflage netting, an M2A3 of 1-16 Infantry, 1st ABCT, rumbles across the Smardan Training Area, Romania, in June 2019. (U.S. Army photo by Staff Sgt. True Thao)

which has been affected by the changes introduced as a result of combat experience since Operation Iraqi Freedom. These include better automotive and transmission components, better engine management systems and upgraded digital battlefield management and communication systems that will ensure the compatibility of the Bradley with the M1A2 SEP V3 MBT. In June 2014 BAE Systems Land and Armanents received a contract to upgrade 164 M2A2 ODS and M2A3s to this new A4 standard. The Bradley chassis is also being employed as the base for the Army's new Armored Multi-Purpose Vehicle, designed to replace the M113 in the various roles it still fulfils in the U.S. Army. This turretless version of the Bradley underwent its first field trials in 2018 and there are plans to produce 160 such vehicles a year. No other NATO allies or partners currently employ the





Back at Fort Stewart, GA, BESVs of 10th Engineer Battalion conduct their Gunnery Table XII exercise in December 2016. This affords a good new of the TOW missile launcher about to fire. (U.S. Army photo by Spc. Ryan Tatum)



Soldiers from 2-4 Cavalry, 2nd ABCT, test the new Bradley-based Armored Multi-Purpose Vehicle at Fort Hood, TX, in September 2018. (U.S. Army photo by Maj. Carson Petry)

Bradley (although it is used by Lebanon and Saudi Arabia). In December 2019, however, the Croatian Defence Minister confirmed that his country would acquire sixty M2A2 ODS to equip a heavy infantry battalion by 2021.

## Conclusion

Like the M1 Abrams, the Bradley Fighting Vehicle will remain a stalwart of the United States' and NATO's warfighting capabilities for the foreseeable future. It is a tried and tested combat platform. Designed for peer-on-peer combat at the height of the Cold War, it has been successfully modified for low-intensity warfare and now once again is being deployed to meet the challenges posed in the new geo-political context that follows Russia's 2014 intervention in Ukraine.



Another National Guard unit, 1-221 Cavalry, Nevada Army National Guard, rehearse tactical movements in their M3A3s in June 2019. Note the old-style tracks fitted to this vehicle. (U.S. Army photo by Spc. Dominic Trujillo)



## Leopard 2



**A Bundeswehr Leopard 2A6.**  
(U.S. Army photo  
by Markus  
Rauchenberger)



**A Danish Leopard 2A5DK in Afghanistan as part of NATO's mission there between 2008 and 2014. The tanks were extensively modified with slat armour and the distinctive The Barracuda Technologies Mobile Camouflage System (MCS).** (Danish Defence Command)





# Leopard 2

**David Grummitt** looks at the NATO standard Main Battle Tank.

The Leopard 2 is the most widely used Main Battle Tank in NATO, equipping the armoured forces of Germany, Canada, Austria, the Netherlands, Poland, Spain, Denmark, Sweden, Norway, Finland, Greece, Portugal, Switzerland and Turkey, and it is scheduled to replace the T-72 in Hungarian service by

2020. In its four decades of service it has undergone various production changes and is widely acknowledged as the most effective MBT on the modern battlefield.

## Development

The origins of the Leopard 2 can be traced back to the 1960s and the failed MBT-70 project between the Federal Republic of Germany and the United States. In 1967 the West German government ordered Porsche to begin developing a replacement for the Leopard 1, the so-called vergoldeter Leopard ('Gilded Leopard'). At the end of this process in 1970 there existed two prototypes, the Keiler or 'Tusker'. Various more prototypes were built and tested over the following three years, fitted with either a 105mm and 120mm, and with the XM150 gun/missile launcher of the MBT-70. Various hulls



A Leopard 2A6NL showing the characteristic smoke dischargers fitted to Dutch Leopard 2s. Some of these tanks were later transferred to Finland, which still sport these non-standard launchers. (Patrick Winnepenninckx)



A Leopard 2A5NL of 11 Tankbataljon on the Drawsko Pomorski Training Area in Poland in June 2002 before their deployment to Bosnia as part of NATO Stabilisation Force (SFOR). (Dutch Institute for Military History)



## Leopard 2



**A Leopard 2A6 of the Bundeswehr's 4 Kompanie, 104 Panzerbataillon moves into position in the ranges at Grafenwoehr Training Area during Exercise Iron Panzer in December 2011.** (U.S. Army photo by Gertrud Zach)



**A Leopard 2A5DK from the Jutland Dragoon Regiment at the Drawsko Pomorskie Training Ground in Poland during Exercise Saber Strike 15.** (U.S. Army photo by Sgt. Brandon Anderson)



**A Bundeswehr Leopard 2A5 at the Joint Multinational Readiness Center in Hohenfels during Exercise Combined Resolve V in October 2015.** (U.S. Army photo by Staff Sgt. Carol A. Lehman)

and automotive parts were also tested before, in 1973, it was agreed that the United States and West Germany would develop their own tanks, the XM1 and Leopard 2 respectively, which would have a high degree of compatibility. By June 1976 a prototype Leopard 2AV was ready and later that year two hulls and three turrets were shipped to the United States to take part in field trials alongside the XM1. The trials demonstrated the superiority of the 120mm gun over the 105mm one fitted to the XM1, while the Leopard 2 was at least the equal of the XM1 in terms of mobility. Nevertheless, probably for political reasons as well as the slightly cheaper cost, the Americans opted for the XM1, leaving the Germans to ponder the future of the Leopard 2.

### Into Service

Throughout 1977 the Germans continued their development of the Leopard 2 prototype and in September 1977 the order was given for 1,800 tanks with Kraus Maffei the main contractor, assisted by Maschinenbau Kiel, who were to produce 45% of the tanks. The first tanks were delivered to the West German army in October 1979 and by 1982 380 Leopard 2s had been produced. Various production improvements followed and when the last Leopard 2A4 was produced for the German army in March 1992 2,125 tanks had been produced.

The Leopard 2 proved itself a formidable weapons system for the Cold War. It provided the backbone of the German Panzerwaffe during the 1980s, proving itself at least the





**A Leopard 2 crew from 104 Panzerbataillon confer with a U.S. Army Observer Controller at the Joint Multinational Readiness Center in Hohenfels during Exercise Saber Strike 2012. (U.S. Army photo by Markus Rauchenberger)**



**A Leopard 2A5 of the Polish 34th Armoured Cavalry Brigade during the Strong Europe Tank Challenge in May 2016. (U.S. Army photo by Spc. Nathanael Mercado)**



Leopard 2



1 Leopard 2A5NL, 41 Tankbataljon, Exercise Griffin Diversion, Bergen-Hohne, Germany, June 2001. This Leopard 2A5NL is finished in the standard three-colour NATO camouflage.



NATO Green  
(Vallejo 71.093  
NATO Green)

NATO Black  
(Vallejo 71.057  
NATO Black)

NATO Brown  
(Vallejo 71.249  
NATO Brown)

Off White  
(Vallejo 71.045  
US Grey Light)

Red Brown  
(Vallejo 71.041  
Tank Brown\*)

3 Leopard 2A5PL, 34th Armoured Cavalry Brigade, Strong Europe Tank Challenge, Grafenwoehr Training Area, Germany, May 2017. This Leopard 2A5PL is also finished in the standard three-colour NATO camouflage.



5 Leopard 2E, Brigada Extramadura XI, Ejercito de Tierra, Cerro Muriano Training Ground, Corboda, Spain, 2017. Spanish Leopard 2Es are finished in an overall coat of NATO Green.

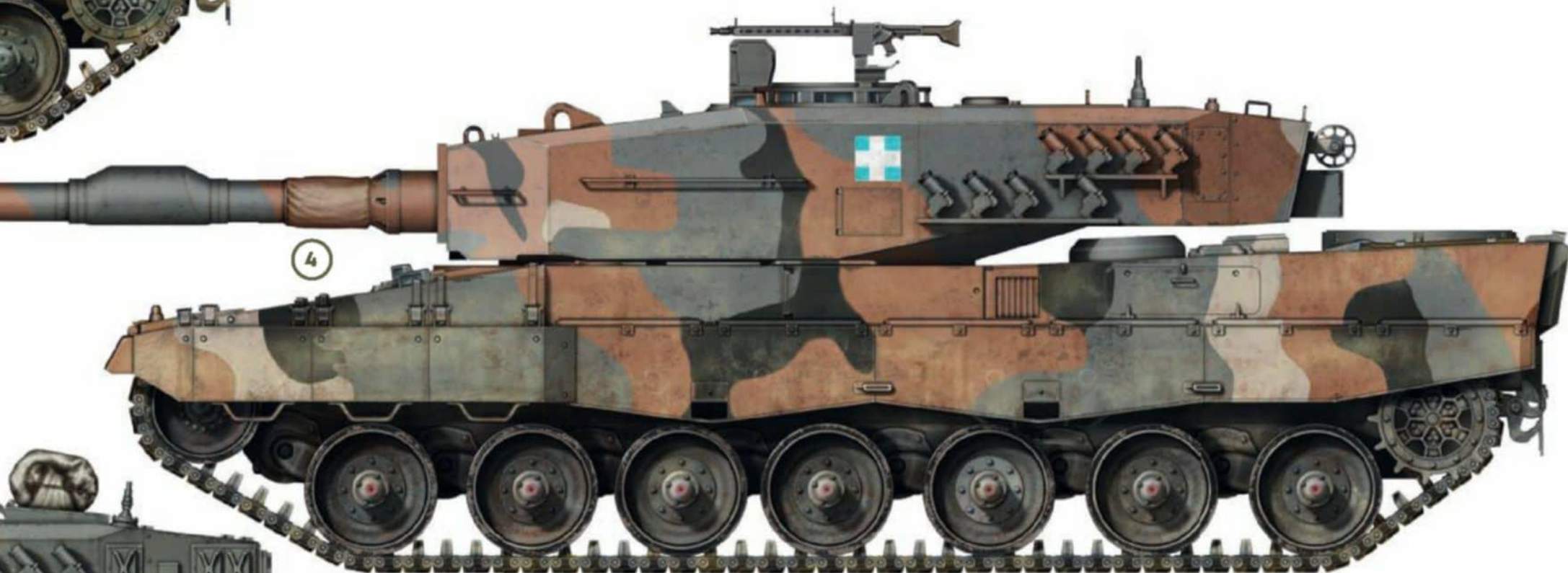




**2** Leopard 2A6, Panzerbataillon 104, Exercise Iron Panzer, Grafenwoehr Training Area, Germany, December 2011. The foliage camouflage that obscures much of the turret and hull front is typical of German Leopard 2s in the field.



**4** Leopard 2A4HEL, Hellenic Army, Oxi Day Parade, Thessaloniki, Greece, October 2018. This tank is painted in a pristine coat of the distinctive Greek four-colour camouflage applied to both the Leopard 2HEL and the older Leopard 2A4HEL.



**All paint references are to Vallejo Model Air**

For more details on Vallejo's range of colours, please visit their website [www.acrylicosvallejo.com](http://www.acrylicosvallejo.com)





## Leopard 2



A Bundeswehr Leopard 2A6M during the Strong Europe Tank Challenge in 2017. The German Leopard 2s came second behind the Austrian team equipped with the older Leopard 2A4. (U.S. Army photo by Gertrud Zach)



A member of the winning Austrian team replaces the track on his Leopard 2A4 at the Strong Europe Tank Challenge in 2017. (U.S. Army photo by Spc. Nathanael Mercado)



Two Swedish Stridsvagn 122s of the Skaraborg Regiment during the Strong Europe Tank Challenge in June 2018. The Swedes came second behind the German Leopard 2A6. (U.S. Army photo by Gertrud Zach)



The winning team: Bundeswehr Leopard 2A6 from Panzerbataillon 393 during the Strong Europe Tank Challenge in June 2018. (U.S. Army photo by Spc. Rolyn Krof)





**Heavily camouflaged Leopard 2A6 of Panzerlehrbataillon 93 at Engerdal, Norway, during Exercise Trident Juncture in November 2018.**  
(Germany Army photo by SGM Marco Dorow)

equal of the American M1 Abrams and superior to the British Chieftain and Challenger 1. It was also adopted by the Dutch army who had equipped three battalions with Leopard 2 by 1986. The third country to adopt the Leopard 2 was Switzerland who received their first tanks in 1987, building the so-called Panzer 87 under license in Switzerland until March 1993.

The Leopard 2 first saw combat service in the Balkans as part of NATO's missions in Bosnia and Kosovo. In 1996 Dutch Leopard 2A4s were deployed to Bosnia as part of NATO Stabilisation Force (SFOR), where they remained until SFOR's disbandment in 2004. Two years later 28 German tanks were deployed to Kosovo. The Leopard 2A4s and 2A5 of the Bundeswehr remained there until 2004.

### **A Tank for a New Age**

The end of the Cold War did not mean the end of tank development in European NATO countries. In 1989 the German military procurement agency embarked upon the Kampfwertsteigerung (KWS or combat potential increasement) programme. This was in two stages. The first planned to increase the firepower of the Leopard 2 by replacing the L/44 120mm gun with a longer L/55 version. The second changed the appearance of the tank radically by the adoption of additional sloped armour modules on the front. The KWS II changes were adopted first, resulting in the Leopard 2A5 of which 225 were upgraded between 1995 and 1998 and a further 125 from 1999 to 20002. The adoption of the new barrel did not happen until 2001, however, with 225 tanks



**A good view of the turret rear of the a Leopard 2A6 from Panzerlehrbataillon 93 of the Very High Readiness Joint Task Force (VJTF) in Rena, Norway, during Exercise Trident Juncture in October 2018.** (Allied Joint Force Command Naples)

being upgraded to Leopard 2A6 standard up to 2005 (most of these were Dutch tanks). In 2006 the Leopard 2A6M was introduced with additional belly armour to defeat mines and IEDs, while in 2014 twenty ex-Dutch Leopard 2A6NL were returned to Germany and upgraded with a new auxiliary power unit (APU, meaning the tank's systems can be operated without running the engine), a new crew-compartment cooling system, new combat management and information system



## Leopard 2



**A Bundeswehr Leopard 2A6M during Exercise Noble Jump in Poland, January 2019.** (U.S. Army photo by Sgt. 1st Class Michael O'Brien)

and new ammunition for the main gun. This latest version of the Leopard 2 to enter Bundeswehr service is known as the Leopard 2A7.

### **NATO's Standard Tank**

Following the end of the Cold War, the Leopard 2 emerged as the most widely used MBT in NATO service with many of the 2,000 or so Bundeswehr or Dutch Leopards being sold or leased to other NATO members. In 1997 Denmark bought 51 German Leopard 2s which were upgraded to Leopard 2A5DK standard, and a further eighteen ex-German tanks seven years later which saw combat service as part of the NATO mission in Afghanistan. In 1998 Austria purchased 114 surplus Leopard 2s from the Netherlands and these continue to serve to this day. Four years later Finland replaced its ageing fleet of T-55s and T-72s with 124 German Leopard 2s and in January 2014

these were augmented by a hundred Leopard 2A6NL from the Netherlands. In 1998 the Greek government purchased 183 tanks from the Germans and in 2005 these were augmented with 170 newly built Leopard 2HEL. Based on the Leopard 2A6, the Leopard 2HEL is among the most potent Leopard 2s in service. Norway purchased 52 Dutch Leopard 2NLs (a Leopard 2A4) in 2001, while Poland purchased 128 German Leopard 2A4 in 2002 and a further 105 Leopard 2A5 in 2013. In 2007 Portugal acquired 37 Leopard 2A6NL from the Netherlands, while Canada purchased eighty Leopard 2NL from the Dutch. In the same year the Canadians also purchased twenty Leopard 2A6Ms from Germany. These were modified for service in Afghanistan and served in the NATO mission there between 2007 and 2011. Sweden is one of the most important users of the Leopard 2, with 160 ex-Bundeswehr Leopard 2A4 delivered between 1997 and 2001. In 1995 they also acquired



**A Leopard 2HEL photographed in October 2018 during the annual commemoration of the Greek Revolution against the Ottoman Empire in 1821.** (Fanis Boskos)





**Another Leopard 2A6M is towed by a Bergepanzer BPz3 Büffel across the training area in Zagan, Poland, during Exercise Noble Jump.**  
(U.S. Army photo by Sgt. 1st Class Michael O'Brien)



**Another Leopard 2 variant: the Leopard 2E of the Spanish army on exercise in southern Spain in 2016.** (Stefan de Graef)

the first Stridsvagn 122, a purpose-built Swedish version of the Leopard 2A5. The Strv 122 was then built in Sweden and 120 tanks currently serve with the Swedish Army. Spain received 108 Leopard 2A4 in 1998 and then 219 Leopard 2E (a Leopard 2A6 broadly similar in capability to the Strv 122 and the Leopard 2HEL) were manufactured first in Germany (thirty vehicles) and in Spain. In 2005 Turkey procured 289 Leopard 2A4 from Germany.

## Conclusion

The Leopard 2 will continue to provide the mainstay of the armoured forces of European NATO countries for the foreseeable future. The Bundeswehr has recently expanded its number of armoured battalions as a result of the renewed

Russian threat and several European nations are either expanding or renewing their MBT fleets. The Dutch, who disbanded their tank forces in 2011, have recently announced they are taken tanks out of storage and leasing German Leopard 2A6 to form a new tank squadron. Poland too has upgraded its fleet of Leopard 2A4 to the new Leopard 2PL. Denmark has already taken delivery of the first of their new Leopard 2A7DK. Portugal is upgrading its small force of Leopard 2A6 at a cost of 46 million Euros between 2026 and 2030, while Cyprus, Greece, Romania and Spain plan to launch a joint programme in 2020 to either procure for the first time or update their tanks to Leopard 2A7 standard. Whatever the future brings, the Leopard 2 will be around for some decades to come.





# Iron Wolf 2018

**Stefan Degraef** and **Edwin Borremans** report from NATO's enhanced Forward Presence Lithuania Battleground Evaluation.

In July 2016, NATO decided at its Warsaw Summit to reinforce the defensive capabilities of Poland and the Baltic States (Estonia, Latvia, Lithuania) by creating multinational 'enhanced Forward Presence (eFP) Battlegroups (BG). This new military concept swiftly unrolled; all four Battlegroups, each 'crewed' by up to 1,250 soldiers on a regular rotational basis, were deployed from the beginning of 2017 to these various countries. Each of the individual BGs will be managed by a 'Framework Nation (FN): United Kingdom (eFP BG Estonia), Canada (Latvia), United States

(Poland) and finally Germany as Framework Nation for the 'eFP BG LTU' (enhanced Forward Presence Battlegroup Lithuania).

As part of the fourth rotation (lasting from August 2018 until January 2019, Germany, as 'eFP BG LTU'-framework nation, was assisted by forces from the Netherlands, Belgium, the

Czech Republic, Luxembourg and Norway, all deploying army units, personnel, vehicles and their fighting capability on a rotational base to Lithuania. Based in Rukla, located some 90km from Lithuania's capital Vilnius, the eFP BG LTU is integrated into the Mechanised Infantry Brigade 'Iron







A Leopard 2A6M of the Bundeswehr's Panzerbattalion 393 takes up position on the Pabrade training area.



A VBM Freccia Infantry Fighting Vehicle of the Italian No.7 Bersaglieri Regiment.



M113A1s of the Lithuanian 'Iron Wolf' Brigade. These vehicles came from ex-Bundeswehr stock in the early 2000s.

Wolf' (MIB IW) of the Land Forces of the Lithuanian Armed Forces. Other Iron Wolf units are located in Panevezys and Alytus, located close to the Lithuanian-Kaliningrad-border. One the brigade's subordinated battalions, the General Romualdas Giedraitis Artillery Battalion, operates modern ex-German Bundeswehr Phz2000 self-propelled howitzers.

By far the largest exercise regularly carried out by the Battlegroup is the annual two-week long 'Iron Wolf' exercise, organised in November 2018 on the vast 'General Silvestras Zukauskas' training area near Pabrade, close to Lithuanian/Belorussian border.

## Iron Wolf 2018

The main objective of the annual Iron Wolf exercise is

to implement, train and assess and provide an in-depth evaluation of Lithuania's Mechanised Infantry Brigade 'Iron Wolf' and its multinationally-composed eFP BG and their ability to plan and complete defensive/delaying actions in their assigned area of operations in Lithuania.

The exercise began on 4 November 2018 and all participating Lithuanian and NATO units were put on alert and prepared their vehicles and hardware for a tactical deployment to Pabrade. Although a swift mobilisation and tactical displacement of all forces needed to reach their tactical positions all over Lithuania was one of Iron Wolf 2018 objectives, only main public roads and more compact logistical military columns were used in order not to disturb civilian traffic. Being capable of crossing the 150km during daylight, night stops of the various columns were organised in various en-route staging areas.

After arriving in their various staging/assembly areas on the Pabrade training area, the participating Lithuanian and eFP forces started to prepare the first part of the exercise scenario. They were ordered to delay or block an adversary attack on the village of Pabrade by crossing the wooded training polygon. Swift exploration of the available 'battlefield' and its tactically exploitable characteristics (dense wooded areas, small lakes and a easily to monitor open area) quickly enabled the Czech and Belgian eFP-forces, using their versatile and mobile Piranha and Pandur infantry fighting vehicles, to preposition three defensive lines to absorb, delay and 'streamline' enemy advances by luring them into a well-hidden and potent 'tank-trap'. This consisted of highly capable



## Iron Wolf 2018



The Freccia can carry an infantry squad of eight soldiers and is armed with the Oerlikon KBA 25mm automatic cannon and a co-axial 7.62mm MG, as well as a turret-mounted commander's MG.



A Marder 1A3 of 'Blue Forces'. This affords a great study of the weathering effects seen on these vehicles.

Leopard 2A6M main battle tanks of Panzerbattalion 393 of the German Bundeswehr. To block the enemy attack on other parts of the battlefield, CV9035NL armoured infantry fighting vehicles of the 44th Armoured Infantry Battalion of the Dutch Koninklijke Landmacht, supported by Fennek-reconnaissance vehicles prepared to fight off the enemy forces in the wooded areas.

During Iron Wolf 2018 the 'Iron Wolf' brigade (the 'Blue Forces') were opposed by a multinational 'Red Forces' battlegroup comprised of Lithuania's Land Forces and the various 'enhanced Forward Presence Battlegroup Latvia' forces deployed to Pabrade. The main component of the 'Red Forces' was No.7 Bersaglieri Regiment of the Italian Esercito, bringing their potent Freccia Veicolo Blindato Medio (medium infantry fighting vehicles) to Lithuania, joined by two Canadian Coyote reconnaissance vehicles and several lightweight Latvian Army and British Army vehicles optimised for operations in wooded areas. Not willing to redeploy eFP-Latvia BG's main battle tanks (Spanish Army Leopard 2E and

Polish PT-91s), two 'local' German Army Leopard 2A6M main battle tanks and two Marder 1A3 infantry fighting vehicles were assigned to the 'Red Forces'. The Lithuanian Land Forces, proving to be very proficient in woodland-warfare using various M113 variants, were assigned to both forces, as was one battery of German PhZ2000 self-propelled howitzers of the Artillerielehrbattalion 345, based at Idar-Oberstein (Germany), for simulated artillery/smoke-laying-support.

Initially briefed to absorb and 'defuse' the initial attack by the 'Red Forces' by at least ten hours and to retreat no more than 6km, the multinational 'Iron Wolf' brigade was able to exceed its mission settings by successfully stopping the 'costly' enemy's 'push forward', well before having to pull back to their well-prepared third line of defence.

## Counter-Offensive Operations

The final part of 'Iron Wolf 2018' was used to practice some advanced counter-offensive simulations by launching the 'Iron Wolf' brigade from a prepositioned start line. The main

Other tracked IFVs serving the eFP Battlegroup Lithuania are the CV9035NLs of the Dutch 44th Armoured Infantry Battalion.







The Pandur II is an 8X8 wheeled IFV operated by the Czech forces assigned to eFP Battlegroup Lithuania. It is armed with the Israeli-made Rafael RCWS-30.



The Transportpanzer (TPz) Fuchs is a workhorse of the modern Bundeswehr. This is a Fuchs 1A4A2 Engineer vehicle.



One of the two Leopard 2A6Ms assigned to 'Red Forces' for Iron Wolf 2018.

focus was the liberation of the Polygon's 'Vilnius' Urban Area by the multinational forces, headed by a deception-attack led by Dutch CV9035NL infantry fighting vehicles and mounted infantry. Unfortunately the Dutch troops were met by stiff opposition by a British Light Role Infantry Company of the British Army's 1st Battalion, the Yorkshire Regiment, 'targeting' the IFVs from well-sited and camouflaged Javelin antitank missile emplacements. Eventually British resistance was 'broken' by a simulated artillery barrage launched by the Bundeswehr PhZ2000 howitzers, under guidance from a Royal Norwegian Army target acquisition and Joint Terminal Attack Controlling (JTAC)-team.

At the same time the Czech 41st Mechanised Battalion, supported by the Belgian Mechanised Infantry Company of the 1st/3rd Batalion de Lanciers succeeded in outflanking the 'Red Forces' and liberating the Urban Area. Defending 'Red Forces' main battle tanks and infantry fighting vehicles were hunted down, sometimes at very close range, by the 'Blue Forces' Leopard 2A6Ms to prevent possible counterattacks from the surrounding wooded areas. On 19 November Iron Wolf 2018

came to an end in a live-fire demonstration by all the participating 'Mechanised Infantry Brigade Iron Wolf' forces, attended by a large number of international military and political dignitaries.

Iron Wolf 2018 was considered a total success, enabling all participating forces to train in a realistic operational setting as a determined strike-package. For the units of smaller, but highly motivated, militaries, the ability to operate alongside more modern equipped army units, especially those of the German Bundeswehr, offers

a quantum leap in operational experiences. For Lithuania and its national armed forces, 'Iron Wolf' demonstrates this Baltic nation's commitment to full and capable NATO membership.



A well-camouflaged Piranha DF90 Fire Support Vehicle belonging to the Belgian contingent of eFP Battlegroup Lithuania.



A Czech BVP-2, the license-built version of the Soviet BMP-2, at the Hohenfels Training Area during Exercise Saber Junction 2012. (U.S. Army photo by Markus Rauchenberger)



# Allies and Partners

**David Grummitt** looks the eclectic mixture of AFVs in service with the Alliance and its partners.

The North Atlantic Treaty was signed by the United Kingdom, France, Belgium, the Netherlands, Luxembourg, Canada, Portugal, Italy, Norway, Denmark, Iceland and the United States on 4 April 1949 marking the beginning of the longest-lasting international defensive alliance in history. Designed to meet the threat of Soviet aggression at the onset of the Cold War, NATO's form and function has changed greatly in the seventy years of its history. In 1955 the incorporation of West Germany

into the alliance led to the formation of the rival Warsaw Pact and for 45 years the prospect of a war between the two superpower-led blocks on the West German plain dominated the military and geopolitical priorities of NATO's members.

The collapse of the Soviet Union in 1991 marked a shift in NATO's strategy. Between 1992 and 1995 it was drawn into the conflict in Bosnia and four years later became embroiled in the conflict in Kosovo. In 2001 Article 5 of the North Atlantic treaty,





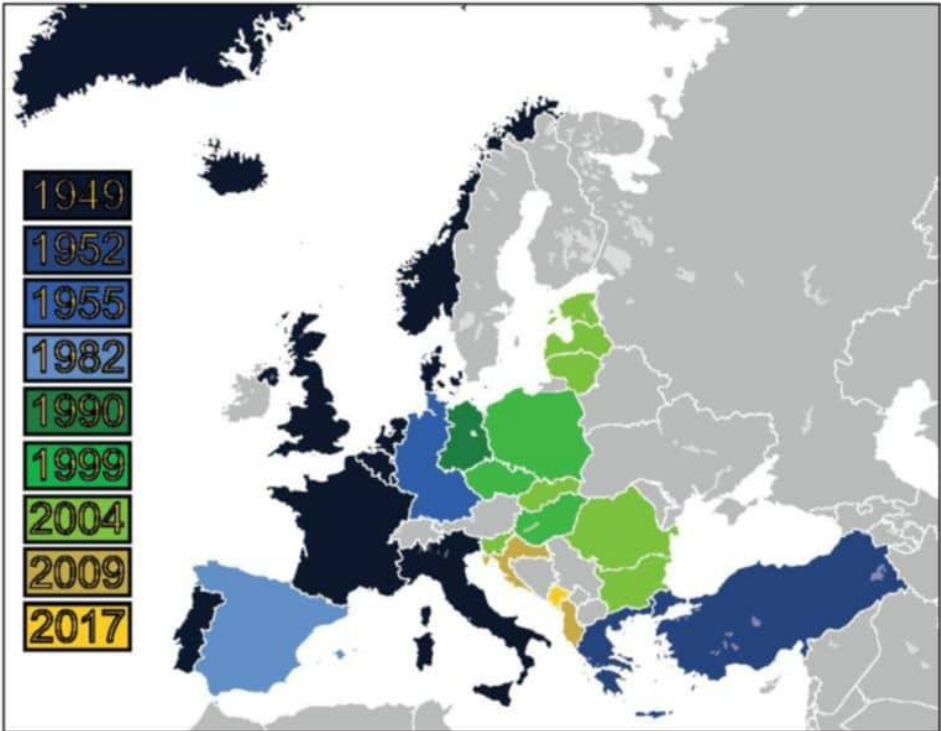
A Slovenian LKOV Valuk, an improved version of the Austrian-designed Pandur 6x6 APC, during Exercise Saber Strike at the Joint Multinational Readiness Centre at Hohenfels in October 2012. (U.S. Army photo by Sgt. Ian Schell)



A Hungarian BTR-80M trains alongside Bradley CFVs of 1-7 Cavalry, 1st ABCT, at Varpalota, Hungary, in August 2018. (U.S. Army photo by Sgt. Christopher Case)



Map showing NATO Partnership for Peace nations (orange), Individual Partnership Action Plan nations (yellow) and Membership Action Plan nations (light blue).



Map showing the enlargement of NATO between 1949 and 2017. (Glentmara, CC BY-SA 3.0)



Allies and Partners



**A Slovakian Box 8x8 Infantry Fighting Vehicle, based on the Finnish-built Patria Armored Modular Vehicle, during Exercise Slovak Shield in September 2018.** (U.S. Army photo by Pfc. Christina Westover)



**Romanian TR-85M1s play the role of OPFOR (Operational Force) during Exercise Combined Resolve XI in December 2018.** (U.S. Army photo by Spc. Richard Trinh)



**Slovenian M-84s take up position at the Hohenfels Training Area during Exercise Allied Spirit IV in January 2016.** (U.S. Army photo by Sgt. Brianne Roudebush)



**Weathered Georgian T-72B1s train alongside U.S. forces in Vaziani, Georgia, during Exercise Noble Partner 17 in August 2017.** (U.S. Army photo by Sgt. Kalie Frantz)





**A Polish PT-91 Twardy MBT, a development of the Soviet T-72M1, during Exercise Saber Strike 18. The Poles operate the PT-91 MBT and the Leopard 2A5.**  
(U.S. Army photo by Hubert Delany)



**A Ukrainian T-64 operates as OPFOR against U.S. soldiers of the 10th Mountain Assault Brigade at the Combat Training Centre Yavoriv in Ukraine in September 2019.** (U.S. Army photo by Lt. Lynn Chui)





**Slovenian M-84s during Exercise Combined Resolve XII in August 2019. Forces from Armenia, Bosnia, Bulgaria, Croatia, Denmark, Finland, Georgia, Greece, Kosovo, Italy, Latvia, Lithuania, Moldova, North Macedonia, Poland, Romania, Slovakia, Slovenia, Ukraine and the United Kingdom participated in this exercise alongside those of the United States.** (U.S. Army photo by Sgt. Thomas Mort)



**A Polish ZSU-23-4MP Biala SPAAG during a live-fire exercise conducted with U.S. troops in Trzebien, Poland, in July 2016.** (U.S. Army photo by Sgt. Lauren Harrah)



**Romanian T-55AMs line up as part of Exercise Sabre Guardian 19 in June 2019. This exercise involved a host of NATO allies and partners across locations in Bulgaria, Hungary and Romania.** (U.S. Army photo by Lt. Alexander Cornell du Houx)

requiring member states to come to the aid of any member state subject to an armed attack, was invoked for the first and only time after the attacks on the United States on 9/11 and NATO troops were employed as part of the ‘War on Terror’ in Afghanistan.

Since 1991 NATO’s membership has shifted considerably. Former Warsaw Pact members have joined and NATO’s reach now extends to the borders of the Russian Federation. The rise in international tensions following the Russian annexation of Crimea in 2014 and their involvement in the war in Donbass led to a strengthening of NATO’s defences in the Baltic and in

Poland, and an expansion of military cooperation with ‘Partner’ nations, many of them former Soviet Republics. NATO has added thirteen new members to its ranks since the end of the Cold War, while more nations have been incorporated and train alongside the armed forces of members states as part of the ‘Partnership for Peace’.

These changes in NATO membership have led to an odd assortment of armoured fighting vehicles serving alongside each other on NATO exercises. These photographs show the Soviet-designed material of the new Allied and Partner nations on recent NATO exercises in Europe.



# NEW RELEASES

## afv COLOR SERIES

ARMoured FIGHTING VEHICLE

Vallejo's AFV Color Series consist of a comprehensive collection of color sets designed to assist the modeler in all steps of painting the models of armoured and combat vehicles. The colors have been carefully developed to allow for a faithful reproduction of the historical shades of the colors - following the norms, military nomenclatures and operational background. We have counted with the assistance of historical and military specialists adjoined to museums and historical societies for the design of some of these sets.



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1926's to Present  
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Acrylic airbrush colors for painting green patterns on Russian army vehicles

Set of 8 Model Air colors, including all shades of green used for base colors and camouflage patterns. Starting in the early twenties, when the mechanization of the Soviet Union army began.

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Ref. 71.613

**Russian Greens (1926's to Present) (71.613)**  
Set of 8 Model Air colors, including all shades of green used for base colors and camouflage patterns. Starting in the early twenties, when the mechanization of the Soviet Union army began.

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Acrylic airbrush colors for painting British army vehicles in WWII European Theater of Operations

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Acrylic airbrush colors for painting Egyptian and Syrian army vehicles

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71.617 71.618 71.619 71.620 71.621 71.622 71.623 71.624

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**Middle East Wars (1967's to Present) (71.619)**  
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Set of 8 Model Air colors, containing a selection of colors to paint the camouflage patterns on contemporary soviet vehicles, using as reference the official colors of the URSS.

71.633 71.634 71.635 71.636 71.637 71.638 71.639 71.640

Ref. 71.621

**Cold War & Modern Russian Green Patterns (71.621)**  
Set of 8 Model Air colors, containing a selection of colors to paint the camouflage patterns on contemporary soviet vehicles, using as reference the official colors of the URSS.

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COLOR SERIES

WWII British Colors Africa 1939-1943  
Acrylic airbrush colors for painting British army vehicles in North Africa

Set of 8 Model Air colors, containing a selection of shades to paint any type of British army vehicles used between 1939 and 1943 and deployed in African territory.

71.641 71.642 71.643 71.644 71.645 71.646 71.647 71.648

Ref. 71.622

**WWII British Colors Africa 1939-1943 (71.622)**  
Set of 8 Model Air colors, containing a selection of shades to paint any type of British army vehicles used between 1939 and 1943 and deployed in African territory.

Vallejo's AFV series consist of a comprehensive collection of Model Air color sets designed to assist the modeler in all steps of painting the models of armored and combat vehicles.



Each set includes 8 Model Air colors and camouflage patterns drawn by Pablo Albornoz



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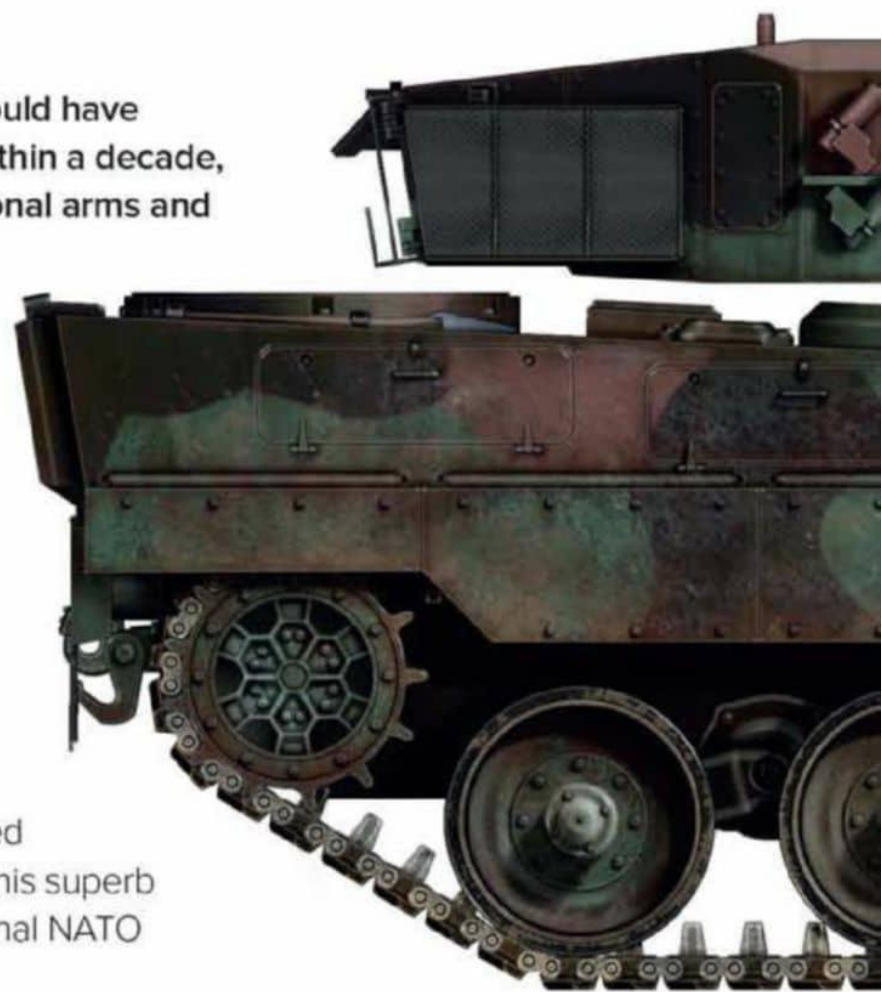
# WARPAINT ARMOUR 2



## NATO ARMOUR 1991-2020

The end of the Cold War and the collapse of the Soviet Union in 1991 should have signalled a lasting 'peace dividend' for the countries of NATO. Instead within a decade, the 'War on Terror' had refocused military spending away from conventional arms and the armour-heavy formations of the Cold War era. However, as the level of NATO's commitment to the wars in Afghanistan and Iraq reduced, Russian aggression in the Crimea and Ukraine led to a renewed emphasis on peer-on-peer warfare and a revival of more traditional forms of armoured firepower.

This book, the second in an exciting new series by Guideline License Publications and the team that brings you Military Modelcraft International, the UK's number 1 military modelling magazine, looks in detail at the armoured fighting vehicles employed by NATO armies, their allies and partners, from the end of the Cold War to today. From the mighty Leopard 2 Main Battle Tank to the ex-Warsaw Pact vehicles now employed by NATO's Eastern European allies and partners, each article provides a unique historical perspective, well illustrated by carefully selected photos, and with individual vehicles illustrated in colour profiles. On top of this superb reference material, a modelling gallery displays some of the most inspirational NATO armour models from the pages of Military Modelcraft International.



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